

MULTI-CASUALTY INCIDENT EXERCISE
MODELING, DATA ACQUISITION, AND PARAMETERS

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PACIFIC GROVE MULTI-CASUALTY INCIDENT EXERCISE MODELING, DATA ACQUISITION, AND PARAMETERS

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INTRODUCTION

The Naval Postgraduate School (NPS) is developing a Domestic Preparedness Response Model (DPRM) to simulate the U.S. domestic response network. Measures of effectiveness (MOE) and analytic methods to evaluate response capabilities will be developed. The model will be parameterized with data from field exercises and games conducted by combinations of local, state, and federal response agencies. It can be used for exercise planning, to evaluate exercise and system MOE, to study “what if” responses for realistic scenarios, to develop recommendations for response system improvements, and to train responders. The model will be applicable for a wide range of disasters, and one ultimate aim is to use it to evaluate and train response to terrorist use of weapons of mass destruction.

The DPRM is a configuration that represents the response system and includes a set of parameters that represents the performance of the units that make up the system. When a simulation is run, the model time steps through response to a specific disaster incident. The configuration depends on both the locality being represented and on the type and extent of the disaster, as is the case in reality. The model must be structured to be easily configured to a specific situation, leading to an object oriented approach. The keys to developing a useful model are realistic configuration and parameters. Simulations produce an output, which is useful only if the model adequately replicates the system of interest and if the model parameters are realistic.

NPS will develop this model in close partnership with domestic responders at all levels, local through federal. Parameters for the model will be obtained by gathering data when some portion of the domestic response system is being exercised or with data archived following real events.

We concentrate first on local response because they are the first and only responders on-scene for some period of time and representing their response correctly is key to any valid model. It is important to use a local system that has well defined, well documented, complete procedures so that a robust baseline model can be developed. California and the Monterey County area are ideal for this purpose because of their extensive and well exercised emergency response system, and Pacific Grove has an award winning emergency response system (Ref. 1), making them ideal candidates for such model development.

California had serious problems during the 1991 East Bay Hills fire in Oakland. Units from different areas couldn't communicate, hose couplings from many responding fire departments wouldn't fit on Oakland hydrants; the lack of standardization was a serious hindrance. Subsequently, California legislated a new Standardized Emergency Management System (SEMS) (Ref. 2). Monterey County and its Cities' procedures are fully compliant with State standards, (Refs. 3, 4).

We wish to model response to large disaster incidents, so exercises utilized for model development must be large enough to stress local capabilities. Only incidents of sufficient magnitude require utilization of the full response network, particularly inclusion of state and

federal level responders. The exercise reported here meets the requirement of involving the full local capabilities, but does not involve state and federal response. It was primarily a medical response; no HAZMAT related response was required, as would be the case for simulated terrorist use of WMD. A terrorist incident will be the subject of a later 1998 exercise. The exercise and results reported here meet the baseline and local size requirements, insuring that we have included a complete set of local procedures (sans HAZMAT), that the response system is well documented, and yields parameters appropriate to a well trained and exercised units.

The Pacific Grove Fire Dept. developed this exercise and it was carried out by the full local disaster response system on Saturday, Nov 22, 1997. The general scenario was:

- collision between a car, van, and school bus
- car on fire, van and school bus on their sides
- 65 victims, 9 dead, 2/3 of remainder requiring immediate or delayed treatment
- 15 fire vehicles, 6 ambulances, 1 medivac helicopter responding
- 3 hospitals admitting victims

This report contains highlights of the exercise plan, followed by sections on data acquisition, modeling, exercise results, and model parameters. The initial report on the details of the exercise can be found in Reference 5.

EXERCISE PLAN

The following is a compendium of the exercise plan "Pacific Grove Fire Department, Multi-Casualty Incident Drill, 22 Nov 97". The original plan was prepared as general information for participants, not as instructions for activities to be undertaken. The plan compendium is in italics to set it off from other report content in this volume.

Background

The Pacific Grove Fire Department has participated each year since 1990 in the City of Pacific Grove's annual functional earthquake exercise. The City participates in the State of California's earthquake exercise scheduled for the first Tuesday in April each year. These functional exercises primarily focus on activation of the City's emergency operations center.

Recently, the Pacific Grove Fire Department has conducted several full-scale multi-casualty incident exercises with a small number of victims. This full-scale drill was designed to provide realistic training in a multi-casualty incident exercise with a larger number of victims.

Goal

The goal of this exercise is to provide training for mass casualty response situations, and to practice the coordination among multiple agencies and their respective emergency management organizations specified in the Monterey County Multi-Casualty Incident Plan (MCI Plan).

Concept

This will be a full-scale real-time exercise. The scenario is a multiple vehicle accident and fire involving an 85 passenger bus, a van, and a sedan. At least 65 injured victims need to be rescued with major extrication problems, triaged, and transported to hospitals in two counties by ambulances and medical helicopters.

The Incident Command System (ICS), the Monterey County MCI Plan, and the City of Pacific Grove's Standardized Emergency Management System (SEMS) Multihazard Functional Plan will be used in the response to a multi-casualty accident. SEMS requires the use of ICS for incident management at the SEMS Field Response level.

Purpose

The purpose of this exercise is to provide realistic training involving multiple casualties to enhance emergency management readiness of the Pacific Grove Fire, Police, and Public Works Departments, participating mutual-aid fire departments, hospitals, Emergency Medical Services (EMS) Agency, medical transport personnel of American Medical Response and Cal-Star, and disaster volunteers of the American Red Cross, and Salvation Army. The Naval Postgraduate School will have an opportunity to collect data for research purposes.

Objectives

- 1. To test Monterey County response capabilities to a mass casualty accident in Pacific Grove.*
- 2. To practice with and evaluate the Monterey County MCI Plan.*
- 3. To practice with and evaluate the ICS (SEMS Field Response Level).*
- 4. To provide hands-on training in a real-life emergency environment with a large number of injured victims.*
- 5. To collect and evaluate critical emergency response data as a part of a research project to develop computer models of mass casualty incidents.*

Artificialities

- 1. Victim injuries will be moulaged or simulated.*
- 2. Exercise communications will be identified as "exercise".*
- 3. Some medical transport may be made by van, simulating an ambulance*
- 4. The vehicles involved in the accident will be pre-staged in place.*

Assumptions

- 1. Exercise weather is actual weather.*
- 2. Exercise time is real time.*
- 3. Normal EMS/Hospital staffing.*
- 4. Pacific Grove Fire, Police, and Public Works Departments will have normal Saturday staffing and equipment levels.*

Exercise Participation

Pacific Grove Fire Department

Pacific Grove Police Department

Pacific Grove Public Works Department

Fire Departments:

Monterey

CDF Pebble Beach

Naval Postgraduate School

Seaside

Monterey Peninsula Airport

Carmel-by-the-Sea

Marina

Highlands

Salinas

Mid-Valley

Monterey County:

Communications Center

Office of Emergency Services

Emergency Medical Services Agency

Cal-Star Air Ambulance

American Medical Response

Carmel Regional Fire Ambulance

American Red Cross:

Monterey County Chapter

Carmel-by-the-Sea Chapter

Santa Cruz County Chapter

Salvation Army

Hospitals:

Community Hospital of the Monterey Peninsula (CHOMP), Monterey

Natividad Memorial Hospital (NMH), Salinas

Watsonville Community Hospital (WCH), Watsonville, Santa Cruz County

Salinas Valley Memorial Hospital (SVMH), Salinas

Doc's Towing, Salinas

American Heat Productions

Naval Postgraduate School

Defense Language Institute

P.G. Fire Dept. MCI Exercise Planning Team

(Representatives from organizations listed above)

References

1. *Monterey County Multi-Casualty Incident Plan (Sept. 1, 1993)*

2. *Pacific Grove SEMS Multihazard Functional Plan (Nov. 27, 1996)*

3. *Incident Command System (SEMS Field Response Level)*

Exercise Control

The Exercise Director will control the exercise. He will also supervise safety and security concerns for the exercise.

Evaluation and Data Collection

The Exercise Director will invite all participating organizations to a debriefing, post-exercise review, and evaluation workshop after the exercise. The purpose of this meeting will be to review the exercise and collect suggestions and recommendations of lessons learned from participants.

A data collection team will be present during the drill to observe the exercise and collect data on a not-to-interfere basis. This special data collection is in addition to information normally recorded by operational personnel in carrying out their responsibilities, such as ICS Form 214 Unit Log. A copy of the usual operational records will be made available to the data collection team after the exercise to be used in preparation of their data report for the Exercise Director. The data collection effort will also be used by researchers at the Naval Postgraduate School in development of computer models of mass casualty incidents.

Communications

Communications will be as specified in the Monterey County Multi-casualty Incident Plan.

Safety and Security

This exercise will involve more than 170 victims, emergency responders, and support personnel. There will also be newspaper and TV station reporters and photographers, data collectors, and official visitors such as Pacific Grove City Council members. Safety should be a matter of concern for all participants.

NO visitors will be allowed within the boundaries of the exercise area unless escorted. This also applies to the media.

Security for this exercise shall be the responsibility of the Pacific Grove Police Department.

Reports

After-Action Report

An exercise after-action report will be prepared and distributed to participants.

Public Information

The Public Information Officer's function will be consistent with the Pacific Grove SEMS Multihazard Functional Plan. Public information will be provided to appropriate media representatives to publicize this mass casualty drill and to enhance relationships with the media. The media, the public, and Monterey Communications Center, and Monterey County Office of Emergency Services have been advised of the exercise through the following action steps:

*Prepare press release
Notification of appropriate agencies
Set up media and observer staging area.
Coordinate with Videographer who is preparing the training video*

During exercise the following steps will be taken:

*Invite media to exercise briefing
Escort media to view area
Provide media with periodic exercise briefings
Escort media to photo opportunity staging area*

Instructions to Participants

- 1. Questions should be discussed with the Exercise Director.*
- 2. Actions should be consistent with the Monterey County MCI Plan.*
- 3. Save and forward all documentation and exercise records to the Exercise Director who will make them available to the Data Collection Team.*
- 4. Be prepared to discuss briefly your comments and lessons-learned at a workshop after the exercise.*
- 5. Complete the Exercise Critique form and forward it to the Exercise Director after the exercise.*

Schedule

0600 Victims report to Pacific Grove Fire Department for moulage, Data Collectors report to Pacific Grove Police Department (Conference Room) for instruction in data collection
0700 Ocean View Boulevard blocked and security posted
0730 Doc's Towing brings bus, van, and car to accident scene
0830 Victims are placed at accident scene, Data collectors on scene
0900 Exercise begins.
1200 Exercise finishes (estimated), Data collectors report back to Police Department to turn in data sheets and review data collection
1400 End of data review (estimated)

Planning Milestones

15 Oct 1997 1030 MCI exercise planning meeting at Pacific Grove Fire Department
4 Nov 1997 1030 MCI exercise planning meeting at Pacific Grove Fire Department
18 Nov 1997 1030 MCI exercise planning meeting at Pacific Grove Fire Department
22 Nov 1997 Conduct Exercise

Scenario

The scenario is a multiple vehicle accident and fire involving an 85 passenger bus, a van, and a sedan. At least 65 injured victims need to be rescued with major extrication problems, triaged and transported to hospitals in two counties by ambulances and medical helicopters. This will be a full-scale exercise.

Safety and Security Plan Details

The purpose of this annex is to outline the measures that will be taken to conduct a safe and secure full-scale multi-casualty exercise. The following are to be observed:

- 1. All participants are required to consider safety first and to alert safety officers of safety issues. Safety officers shall have the authority to stop the exercise.*
- 2. Should any person involved in the conduct of the exercise observe an unsafe condition or sustain a real injury, he/she shall immediately notify a safety officer.*
- 3 The word "FAILSAFE" will be the keyword to stop all exercise activities.*
- 4. In the event of a "real" emergency that requires the response of any of the participants, or should injury occur, "FAILSAFE" will be declared and the exercise shall cease. Medical standby will be contacted immediately.*
- 5. All responses to the scene from staging may be CODE 3 (red lights and sirens), with due regard for traffic. Response from treatment area to simulated hospital will be CODE 2.*
- 6. Emergency medical standby will be provided by one paramedic transport unit at rehab. If that unit is called away, a participating unit will replace it. If participating fire units called into service "FAILSAFE" will be called until situation is adjusted.*
- 7. Victims, when lifted, shall be secured on the litter. When a victim cannot be lifted safely, the victims will be asked to move themselves.*
- 8 All participants and observers shall remain within their designated areas until instructed to move elsewhere both during and at the conclusion of the exercise. All participants shall convene at the blue canopy at the end of the exercise.*
- 9. No person will be allowed within 10 feet of the bus during the tactical portion of the exercise due to the use of smoke devices.*
- 10. Media will be staged in a designated location and identified, and will be escorted to a safe observation point prior to the tactical portion of the exercise.*
- 11. Observers will be staged in a designated area for the entire exercise for their safety.*
- 13. Other possible hazards to be aware of are:*

<i>Trip/fall</i>	<i>Heat stress.</i>
<i>Smoke inhalation</i>	<i>Moving vehicles (inside exercise area and outside).</i>

SECTION I - DATA ACQUISITION PROCESS

DATA NEEDED

The model links response processes with decisions, communications, and the movement of supplies. Response personnel perform the actions and victims move through them. Response activities are modeled with the following basic parameters:

- how long it takes to get things done,
- the activities capacity,
- required supplies, and
- required personnel.

In order for an activity to begin it must be enabled, which is done by

- decisions,
- personnel availability,
- supplies availability, and
- victim arrival.

The data acquisition process is designed to capture information that allows these parameters to be extracted. Data capture is by event logs, which record the times of occurrence of physical events and communications.

As an example of a response units parameters, a single ambulance can be represented by the following information:

- time from initial call to leaving for the scene
- time to travel to the scene
- time to transport to the hospital and time to return
- patient treatment during transit
- number of people that can be transported at a time
- time to unload patients at the hospital
- supplies utilized for a patient in the ambulance
- total supplies available on the ambulance
- time to restock supplies at the hospital
- delivery of supplies from the ambulance to on-site treatment units
- total time a given crew can work the incident before going off duty for recuperation

There are other ambulance related actions which are more conveniently included with other activities. Some of them are: the number of ambulances needed and available, ambulance queue, patient loading, etc. Associating with an ambulance only those actions that belong exclusively to it follows the object oriented approach, where a total process is broken into discernable sub-processes, which can be parameterized separately and linked as needed.

Interactions between response units are needed. As an example, a helicopter can't land until the police have secured the landing area, which requires police on duty and that other personnel have

barricaded the area for safety. Interactions can be invoked by linking objects with decisions or through physical occurrences, and in some cases not allowing a process to begin, or perhaps to continue, until the state of an associated process allows it. The times needed to make and execute decisions are important parameters. Often an activity will not begin until some time has elapsed after the decision to proceed has been made or an enabling activity has occurred. This delay time is an important parameter to be captured.

The easiest way to consider victims in the model is as objects which flow through the system and die if they don't receive treatment within a particular time, depending on the extent of their injuries. In reality, victim health state changes with time and treatment details in a complex way which would require complex data capture to parameterize. In the current state of the model, we do not attempt to track the treatment of victims with their actual injuries as a parameter, but rather have divided them into the broad categories of Immediate, Delayed, and Minor injuries. Thus, for this stage of model development, it is only necessary to determine average treatment rates for the three categories.

DATA ACQUISITION

The data acquisition process was designed to replicate the response process. A data logger was assigned to each of the Commanders, Officers, Chiefs, and Directors of the response system. One was also assigned to each principal response function. The total number of data loggers was 23. The response system which was replicated is the Incident Command System (ICS) structure described in the Monterey County MCI Plan. A block diagram overview of the ICS is shown in Figure 1. A schematic of patient movement through the system is shown in Figure 2.

The Monterey County MCI Plan contains duty checklists for all of the response positions and the unit log form ICS 214. We augmented the duty checklists to include other duties found in the Alameda County MCI response plan. The ICS 214 forms are generic for all response positions, including only time/event logging. For our data logs, we modified them into forms ICS 214N, including prompts for the types of data we expected to be needed for a specific position. For example, for a treatment unit we wished to collect patient triage numbers and types of treatment; for personnel staging we wished to obtain the person's ID and the times on and off duty. The main purpose of the modified forms was to make it easy for the data loggers to capture the significant decision and control events and the physical response events. All data that pertained to victims used triage tag numbers so that individuals could be tracked. Examples of the new duty checklists and data logs for Extrication/Triage (medical) are shown in Figures 3 and 4.

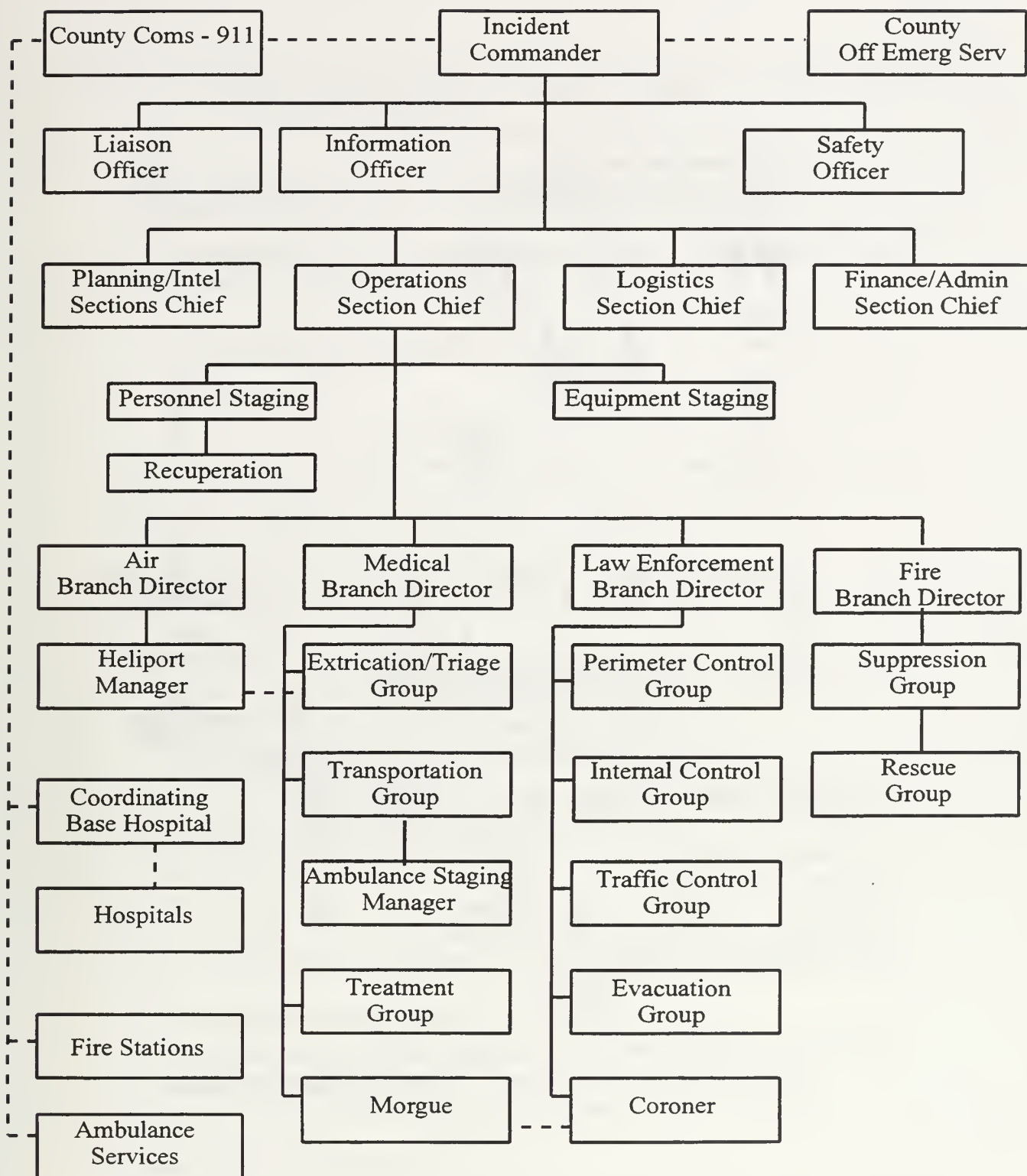
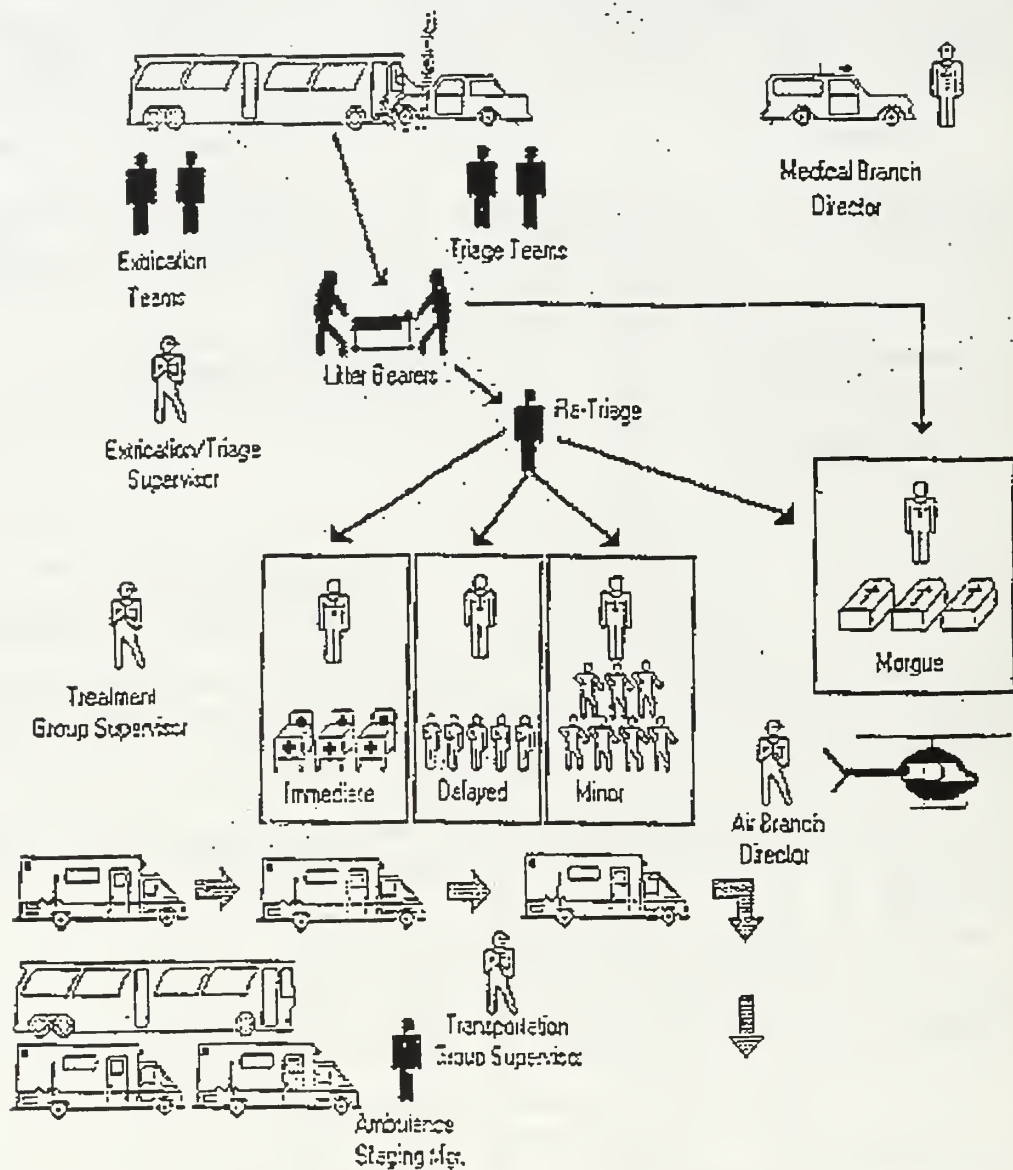


Figure 1. Monterey County Incident Command System. Solid lines indicate supervision, dashed lines indicate communications.

Multi-Casualty Incident Site Plan



Note: Direction of ambulance travel should be established to ensure that they travel to the "Immediate" treatment area then the "Delayed" and finally the "Minor" treatment areas.

Monterey County Multi-Casualty Incident Plan

Figure 2. Schematic of Monterey County Incident Site Plan.

EXTRICATION/TRIAGE GROUP SUPERVISOR & FIRST TRIAGE - DUTY CHECKLIST

Radio Call "Extrication"

Name _____ PG Fire Dept Exercise 11/22/97 Data Collector _____

The Extrication/Triage Group Supervisor reports to the Medical Branch Director. The Supervisor is responsible for site safety, initial point triage, disentanglement of victims, and movement of victims/patients to the treatment areas. The Group coordinates its activities with the Physical Extrication/Rescue Group.

Obtain briefing from the Medical Branch Director	Time _____
Don position ID vest	_____
Verify ability to communicate on assigned frequency	_____
Assess situation and request tools, supplies, triage tags, and personnel	_____
Appoint and brief extrication and Simple Triage And Rapid Treatment (START) triage teams in groups of 2 to 4	_____
Oversee START triage and extrication of victims to treatment areas	_____
Inform Medical Branch Director of:	
- number and extent of injuries (immediate, delayed, minor)	_____
- need for morgue/coroner	_____
Collect torn triage numbers from triage teams	_____
Maintain triage log	_____
Request medical treatment staff attend victims of prolonged entrapment	_____
Continually evaluate mental health status of victims and rescuers	_____
Demobilize the Group and forward all logs, records, checklists, and triage tag numbers to the Medical Branch Director	_____
Maintain Unit Log (ICS Form 214)	_____

Figure 3. Extrication/Triage Group Supervisor and First Triage duty checklist.

TIME	EXTRICATION TREATMENT	TRIAGE RESULT	MOVE	TRIAGE #

Figure 4. Truncated version of the Extrication/Triage NPS unit data log.

There are several other forms in the County MCI plan and there are additional records kept by various response units. These were either adopted by us for data logging or obtained after the fact from the units. They are not presented here, but are:

- Patient Transportation Log
- Hospital Survey
- Ambulance Staging Resources Status (ICS 2-91)
- Mobile Intensive Care Nurse Disaster Plan Checklist (hospital form)
- Base Hospital Multi-Casualty Incident Record
- hospital incoming victim record
- MCI Patient Profiles
- County Communications (911) Logs
- Ambulance Logs
- Helicopter logs

It was difficult to have a widely dispersed response organization synchronize their times, and not all incidents were recorded exactly at the time they occurred. Cross checking the various records to obtain a "best estimated" time for events was needed.

Data loggers were assigned to specific supervisors and areas, such as the Incident Commander, Transportation Group Supervisor, Triage Unit, Immediate Treatment Area, etc. Loggers were also assigned to hospital receiving areas. Victims were tracked up to hospital admission.

No logging of internal hospital processes was done. Hospital logs were used to track the setting up of their response systems and their resulting victim capacity. At this point there is no attempt to track victims once admitted to the hospital, since the model will assume that, once in the hospital, victims are “saved”. For a HAZMAT event, it will be necessary to log data for both victims and responders involved in the decontamination process.

Much emphasis was placed on recording communications and decisions. NPS communications logging was done at the incident site and inside ambulances for their initial trip. The communications of each supervisor were logged. Records from the 911 communications center and each participating hospital were used to complete the picture.

The data loggers were students in the U.S. Air Force 311 Training Squadron at the Defense Language School.

DATA COLLECTION LESSONS LEARNED

This was NPS’s first non-military field operations exercise. There were inefficiencies in the way data acquisition was organized, generally having too heavy an emphasis on matching data loggers to the prescribed command and control structure. Greater flexibility was needed. The specific link between data loggers and individuals involved in the exercise was not crucial, and the extent and quality of the data is high. We have developed additional guidelines for our next field program data collection, and the important ones are presented here.

The data acquisition process placed too much emphasis on following supervisor activities. While shadowing them from place to place, some events were missed by the logger assigned to that type of activity. The number of supervisors tracked could be reduced by a factor of two, concentrating only on key individuals.

More assigned loggers were needed during times that an activity had an intense peak period. A good example is initial triage and extrication. Loggers should have been placed in four locations, with perhaps two additional loggers tracking victims being moved from the immediate crash scene. When the initial surge of activity died down, these loggers could be reassigned.

As the incident evolves, a large number of victims queue up in the treatment areas. If one wishes to keep track of victim status and on-site treatment it is necessary to increase the loggers in these areas in proportion to the number of victims.

In the initial stage of the incident there was no command and control structure but action was ongoing. A logger who is to record a function should record incidents related to the function, then follow the supervisor once designated, rather than doing no recording.

Many events which are general movement of people and things are not in a category. General-area loggers who record events that appear interesting or significant would be helpful. This would also supply an additional set of time marks that would aid in correctly sequencing events.

At the present time we are logging everything. This is probably unnecessary, especially since the model will use averages for many processes. Once the exact data needed for the desired model fidelity is understood, we will reduce the total collection effort by focusing on critical areas.

SECTION II - EXERCISE RESULTS

EXERCISE MODEL PARAMETERS, GENERAL CONSIDERATIONS

The exercise has yielded more than one set of model parameters. First, there are parameters that come from established response guidelines (such as that the first victim is to be on the ambulance for transport to the hospital in less than 10 minutes from the time the first ambulance arrives on scene). Second, are actual on-site occurrences (such as the first ambulance departing much later). Third, there are corrections to parameters for activity modifications due to this being an exercise, (such as ambulances not using their sirens, perhaps resulting in longer transportation times).

In some cases it is easy to decide which parameter is the "best", keeping in mind that one wishes to model response to actual disasters, but for some parameters it is not obvious. The best example of a difficult parameter selection decision is the case of excessive time before transport of the first victim in this exercise. We have not determined whether it was due to

- local rescuers deciding that extrication is more important than treatment and transport,
- this being an exercise and the execution of tasks being atypical,
- insufficient resources for this magnitude incident,
- inefficiency due to lack of training for this magnitude incident, or
- lack of supervision.

The following illustrates the process of choosing parameters for a response model, again using the first patient transport time as the example. To make the decision for which time to use, we need to know the purpose of the model. Possibilities are:

- replicate ideal performance,
- replicate actual performance,
- evaluate the effects of delayed transport, or
- training to illustrate the effects of decision making.

If one wishes to replicate ideal performance the guideline time would be used, whereas replicating actual performance would require the actual time. For both evaluating delayed transport effects and training, one would wish to have both times available. One would compare MOE evaluations for delaying and not delaying initial transport. It is not obvious that delayed transport will degrade response performance. It is possible that it is more important to quickly extricate and treat critical victims with the rescue manpower available.

It is important to note that, if one wishes to evaluate the effect of decisions, such as to delay transport in order to extricate and treat, one must have a cohesive set of parameters. The extrication, treatment, and transport times must be consistent for the situation being evaluated, and they must be consistent with the number and types of personnel available to carry out the operations.

It is not the purpose of this report to make these parameter decisions. Here we report the data as they were obtained and the resulting parameters. Use of the parameters in the model will be the focus of later work.

Tables of event times extracted from the original data logs are presented in the Appendix. The data are organized into the following categories, which fairly closely represent the Incident Command System structure and some additional useful information for modeling:

Incident Commander	Public Information Officer
Liaison Officer	Safety Officer
Logistics Section Chief	Operations Officer
Personnel Staging	Equipment Staging
Fire Branch Director	Rescue
Medical Branch Director	Extrication/First Triage
Transportation Group Supervisor	Ambulance Staging
Air Branch Director	Treatment Group Supervisor
Re-Triage	Immediate Treatment
Site Communications	Delayed Treatment
Physical Occurrences	Minor Treatment
AMR Logs (ambulance)	Victim Events
Helicopter Logs	County Communications (including 911)
Vehicle Events	
CHOMP MICN (base hospital Mobile Intensive Care Nurse)	

EXERCISE DATA RESULTS

The data is most easy to work with if it is arranged into categories. These categories are not the modeling processes introduced later in this report. The data categories are:

Rescue Personnel - is the movement of personnel into the incident site and the removal of personnel for rehabilitation and return to duty. Police are assumed able to start initial triage but not perform treatment. Firemen and ambulance personnel are assumed to be equally able to perform on-site treatment. Only firemen can perform extrication/rescue and safety.

Provision of Supplies - is making supplies available for rescue operations. We assume that an initial amount arrives with firemen and ambulances, but that later restocking is necessary. For this size exercise, we assume that all supplies needed for area control are available with the initial arrival of police and firemen so are not included as a factor in the model.

Physical Area Control - is the erection of barriers, establishment of staging and landing areas, and crowd control.

Patient Transport - is the movement of patients within the incident site and transport to hospitals. Transport types vary, e.g. "walking wounded" walk to the minor treatment area, thus effectively providing their own transport.

Extrication and Initial Triage - is the initial physical extrication of victims from buildings and vehicles and the determination of their health state. Victims who walk from their initial location are not extricated. Initial triage allows walking wounded to be sorted into a separate category of victim, dead to be identified and initially ignored, and efforts can then be concentrated on those requiring rapid medical care.

Patient Treatment - is treatment and stabilization that occurs at the incident site. In the current status of the simulation, we assume that when patients are admitted to the hospital they move into a "cured" status, thus exiting the simulation.

Command, Control, and Communications - are the enablers for rescue operations. Once an operation is activated we assume that no further communications are needed to keep it going, except for the need for supplies restocking and personnel availability.

We are not including Public Information and crime investigation in the modeling for this exercise.

The following is the event data sorted into the above categories. The times listed to the left of the event are elapsed times from the initiation of the exercise by the call to 911. One can assume that under non-exercise circumstances the call would occur approximately 2 min after the incident occurs. Times listed to the right are the time it takes for that type operation to be carried out.

Rescue Personnel Supply

We track rescue personnel in four categories: police, fire, ambulance, and other.

Fire	8 min - 1st arrival	Police	5 min - 1 st arrival
	9 min - 2 nd arrival		7 min - 2 nd arrival
	13 min - 3 rd arrival		7 total vehicles
	48 min - 4 th & 5 th arrivals	Ambulance	5 min - 1 st arrival
	49 min - 6 th & 7 th arrivals		20 min - 2 nd arrival
	65 min - 1 st outlying arrival		22 min - 3 rd arrival
Other	72 min - 2 nd outlying arrival		31 min - 4 th arrival
	18 min - Red Cross arrives		39 min - 5 th arrival
	19 min - patient transport vans arrive		
	31 min - helicopter arrives		
	41 min - MCI trailer arrives from Monterey Peninsula Airport Fire Department		
	45 min - helicopter lands		
Rehabilitation	88 min - 5 rescuers to rehabilitation		
	90 min - rescuers to rehabilitation in groups of 6		

Time spent in rehabilitation - 5 min
 110 min - rotate area control personnel
 115 min - 10 to 15 rescue personnel at rehabilitation

The initial hospital reports to the base hospital MICN show the following numbers of facilities available:

	Emergency <u>Rooms</u>	Intensive <u>Care Units</u>	Operating <u>Rooms</u>	General <u>Beds</u>
CHOMP	2-3	4	2	10-20
NMH	15	0	unknown	15-20
WCH.	6	closed	1	unknown

Provision of Supplies

5 min - initial medical supplies arrive with 1st ambulance
 8 min - rescue equipment and additional medical arrive with 1st fire truck
 28 min - move stretchers to treatment area
 - backboards from ambulances to treatment area
 - oxygen from ambulance to treatment area
 41 min - MCI trailer arrives with supplies
 - distribute litter boards
 47 min - stretcher from ambulance to treatment area
 54 min - stretcher from ambulance to treatment area
 96 min - additional rehabilitation supplies brought in

Physical Area Control

16 min - begin extinguishing car fire
 18 min - staging area designated
 19 min - car fire out
 20 min - set up traffic control check
 21 min - traffic plan designated
 29 min - ambulance route established
 33 min - establish treatment areas
 39 min - helicopter landing zone set
 80 min - rehabilitation area set up

Patient Transport

The following is the basic information about patient transportation: times initiated, round trip times, dispatch times, and significant events. The dispatch times for all ambulances leaving the incident site are shown below in the Transportation Group Supervisors communications.

8 min - minor injured walk to side of area
 10 min - minor injured walk to treatment area
 all transport from accident to treatment areas within site - 30 sec
 31 min - helicopter delay of 14 min due to confusion and change of landing site
 54 min - first ambulance departure

56 min - helicopter departs
 77 min - minor treatment vans depart
 96 min - 12 have been transported
 117 min to 129 min - delay in patient transport, ambulances unavailable
 122 min - 34 have been transported

The following is a reconstruction of ambulance logs. The original logs were lost immediately after the exercise conclusion. dt is the elapsed time between events.

			arrive		depart		arrive		depart
Num.	enroute	dt	scene	dt	for hosp	dt	hosp	dt	hosp
836	0909	2	0911	23	1034	29	1103 C		
840	0914	11	0925	48	1013	8	1021 C	?	1021
829	0914	14	0928	46	1014	50	1104 N	23	1127
828	0923	13	0936	25	1001	18	1019 C	10	1029
840	1021	8	1029	13	1042	21	1103 C	1	1104
840	1104	10	1114	10	1124	20	1144 C		
829	1127	16	1143		canceled				

The following is a list of patient arrival times from the CHOMP data collector. These times don't agree well with the reconstructed times above.

Num.	Patients	arrive	depart
840	095669	1012	
	095666		
844	095679	1026	1034
	271605		
836	095638	1049	1100
	095682		
846	095696	1054	1103
	095639		
	664373		
844	095700	1104	1113
	095667		
	0956778		
843	095646	1132	
	666131		
846	095647	1136	
	666126		

These data collector times agree well with the patient record times from CHOMP.

The following are some additional times we have gleaned from the data.

fastest ambulance turn around - 40 min (CHOMP round trip)
 one way to NMC - 50 min
 one way to WCH - 45 min

helicopter turn around time - 34 min, add 16 min if refueling needed
helicopter one way to WCH - 11 min

Extrication and Initial Triage

6 min - police begin triage
8 min - minor injured walk to side of area
10 min - start organized triage
11 min - start tagging and moving dead
12 min - start moving injured out of bus
move out an injured person - approximately every 1 min for first 10 victims
25 min - cut bus front seat
36 min - cut bus front bars
40 min - go in van sun roof
42 min - first victim out of van
46 min - extrication complete

Patient Treatment

The data for this category is very sparse. Treatment was fairly continuous, starting shortly after the treatment area was set up. We have no data on what was done for a victim who was in immediate danger of death before the treatment area was set up.

11 min - triage tags distributed
15 min - treatment group set up
20 min - begin minor treatment
24 min - 12 minor have been treated
28 min - move immediate victims to re-triage
30 min - establish victim needs and priorities
35 min - put immediate victims on litter boards
- moved delayed treatment victims to re-triage
- separate minor care victims by needed care and complete treatment
36 min - put neck injured on boards
38 min - move victims to tarps
47 min - assign 2 patients to helo
49 min - report 26 immediate
55 min - report 9 dead
57 min - cover dead
59 min - vans filled with 15 minor
69 min - report 14 dead
79 min - vans ready to leave for WCH
83 min - report 14 delayed, 14 immediate, 35 minor (63)
101 min - move deceased to morgue
102 min - count 14 sent 14 minor remaining

103 min - 19 remain for care,
- 15 in morgue
105 min - 60 treated
109 min - prioritize patients
111 min - report 62 total victims
122 min - final report 34 transported, 13 imm/del remain on site

Command, Control, and Communications

There are four types of communication: 1) communications from County Coms that activate responders, 2) communications between the site and either County Coms or the coordinating hospital, 3) communications within the site, and 4) communications between the coordinating hospital and other hospitals. We do not report all communications here, only those that are required for process activation. In general, the data recording of communications appeared to be inadequate.

County Coms Activation

0 min - 911 call reporting incident
2 min - incident alert transmitted
7 min - MCI system activated
- advise Highway Patrol
9 min - call for MCI trailer
- form fire strike team
10 min - notify CHOMP to be coordinating hospital
12 min - notify Santa Cruz County of MCI
14 min - notify County EMS
16 min - assign orange frequency
19 min - request MCI supply trailer from the airport
21 min - activate CALSTAR helicopter
28 min - Coast Guard advised
42 min to 80 min - coms with fire departments re response
70 min - coroner updated

Incident Commander to County Coms

5 min - request additional resources
9 min - request MCI supply trailer
- request fire strike team
10 min - IC established
19 min - request 4 ambulances and helicopter
24 min - request coroner
40 min - request more personnel
65 min - request additional fire assistance

Transportation Group Supervisor to Coordinating Hospital

These are the decision communication times, not the times of the transportation event.

- 10 min - Transportation Group Supervisor established
- 16 min - establish communications with MICN
 - 2 vans of minor injured to WCH
- 45 min - coordinate initial hospital destinations
- 49 min - report total number of victims
- 50 min - set first hospital destination CHOMP with 2 immediate
- 61 min - send ambulance to NMC
- 72 min - send ambulance to CHOMP
 - send ambulance to NMC
- 78 min - send ambulance to WCH
- 81 min - send minor injured vans to WCH
 - send helicopter to WCH
- 92 min - send ambulance to CHOMP
- 98 min - send helicopter to NMC
 - send ambulance to NMC
- 129 min - send ambulance to CHOMP
- 133 min - send ambulance to CHOMP

Within Site Communications

Within site communications did not appear to initiate processes due to rescue beginning before command and control was established. They did modify who was participating in or in charge of processes. The exception was the movement of and loading of ambulances and the helicopter. Decisions details about patient transport priorities were not captured.

- 11 min - Incident Commander's communications checks
 - Medical Branch briefs personnel
 - Fire Branch direct extrication start, review assignments
- 20 min - air branch establishes radio channel
- 21 min - Fire Branch request equipment and personnel
 - immediate treatment requests personnel and supplies
- 25 min - IC cell phone to fire dispatch to confirm resources
- 27 min - tactical silver to be used
- 30 min - Fire Branch address Treatment Group
- 33 min - helicopter requests landing zone
 - Fire Branch and Transportation Group coordinate
- 34 min - Treatment Group Supervisor establish coms with treatment managers
- 35 min - Treatment Group Supv establish coms with treatment managers
 - second jaws requested
 - extrication short of people
- 40 min - re-triage requests medics, supplies, and litter bearers
 - re-triage personnel assigned

47 min - communicate with hospital for landing zone
52 min - Extrication requests c-spine and back boards
55 min - Treatment and Transportation Groups coordinate patient loading
57 min - law enforcement communications bad
 - Medical Branch tell IC number of injuries
61 min - Medical Branch briefing
63 min - Medical Branch request personnel and equipment inventory from Groups
64 min - request to Equipment Staging for straps, c-spine gear, and collars
66 min - Transportation Group Supv set ambulance rotation
69 min - Ambulance Staging reports 5 ambulances max
71 min - no coms between vans and hospital
 - Transportation Group advise Medical Branch of additional resource needs
75 min - Medical Branch requests more equipment
 - Medical Branch notified of Extrication equipment needs
77 min - Treatment Group call for rehabilitation of personnel
79 min - Medical Branch receives equipment OK report
84 min - Transportation Group and Air Branch coordinate
85 min - Medical Branch requests 2 more engine companies
86 min - Personnel Staging call Logistics for refreshment
 - Medical Branch requests 2 more engine companies
88 min - Operations Officer instructs Salinas Fire on route
97 min - Watsonville hospital reports can take 4 more patients
100 min - Helicopter reports needs ½ hour for refueling
 - Operations briefing

Inter-Hospital Communications

11 min - notify NMC
12 min - notify SVMH (not participating in this exercise)
13 min - notify WCH
14 min - CHOMP communicates resources available
15 min - NMC communicates resources available
14 min - WCH communicates resources available

The following is not event time information as has been presented above. It is a summary of what equipment was on site and details of the states of the victims.

Equipment Details

The following rescue vehicles were on scene during the incident

11 fire engines
2 fire trucks
1 fire pickup
Incident Commander's van
logistics van

3 Red Cross emergency response vehicles (with refreshments)

6 police patrol cars

1 highway patrol car

MCI truck and trailer

1 Salvation Army mobile canteen RV

105 min - rough count 65 to 89

total personnel on scene

Victim details

Records were not kept of victim moulage preparations. Thus, it is difficult to track victims through the rescue process with injury as an independent variable. For future exercises it will be advisable to have a data logger recording victim moulage. We do have somewhat sparse records of victim occurrences, some information on treatment, some on transportation. The following is a summary of that information, from data logs, hospital records, and reconstructed ambulance records. The lack of definitive victim information is not a problem for the current sophistication of the model, but such data will be needed for higher-fidelity treatment modeling.

The following lists the victims triage tag ID number, type category (immediate, delayed, minor), when they were extricated, their health status, the type of treatment they received and when, and to which hospital they were transported and when.

<u>Triage #/type</u>	<u>extric</u>	<u>injury and on site treatment</u>	<u>hospital transport</u>
095602/min		head bruise and thumb wound	1010 van to WCH
095606/imm	0931		
095608/imm			1056 helo to NMC
095627/min		Hurt arm, fractured	1010 van to WCH ER for arm fracture
095628/min		set arm, cuts bruises	1009 van to WCH
095630/imm	0922		
095636/del	0922	1015 c-spine & neck brace	1020 NMC, leg fracture xfer to SVMH for spine
095637/del	0921	upgrade to imm	1056 helicopter to NMC
095638/imm	0922		1050 arrive CHOMP
095639/imm	0922	blunt trauma, 1016 c-spine	1039 to CHOMP, up to imm
095642/del			
095646/imm	0931	1011 put on board, neck	1056 to CHOMP surg ovrlw
095647/imm		face, femur, low back pain	1140 arrive CHOMP
095648/imm	0939	pregnant, 1002 on a board	1007 to NMC
095650/imm	0959	spinal	1106 to NMC spinal xfer to SVMH
095656/			
095657/imm	0939		
095663/min			
095664/del			

095665/imm		0957 O2	1000 helo to NMC
095666/imm	0943	head, 0951n on stretcher	0955 to CHOMP
095667/imm	1040	open face L. arm, low back pain	1052 to CHOMP
095668/			0959 to CHOMP
095669/imm	0932	abdominal evisceration, pulse	0955 to CHOMP
095670/del	0926		
095673/			
095674/		dead	to CHOMP
095675/del		upgrade to imm	
095676		dead	
095677/imm			
095678/		baby dead	xport with mother (095667)
095679/imm	0943	back, 1000 on c-spine, 1004 O2	1028 arrive CHOMP
		2 nd deg burn chest and face	
095680/del	0922	dead	
095681/del	0922	dead	
095682/imm	0925	head, 1015 neck collar	1055 arrive CHOMP
095684/del	0943	upgrade to imm	
095685/			
095694/del			
095695/imm		1006 neck brace	1020 to NMC
095696/del	0922	penetrating facial, 1003 c-spine	1045 to CHOMP
095698/del			
095699/del		burns on arms	van to WCH, to Santa Clara Burn Center
095700/imm			1106 arrive CHOMP dead
271602/min			1010 van to WCH
271603/min			1010 van to WCH, irrational, CAT scan, send Dominican
271604/min		lacerations, fractures	1010 van to WCH
271605/imm		abdominal evisceration	1010 to CHOMP
		1005 O2 and c-spine	
271608/imm			1056 helo to NMC
271610/imm			
271638/del		upgrade to imm	
271694/			
271698/			
664373/min			To CHOMP, 1101 collapse, CPR, 1107 resuscitated
			1052 to CHOMP
666126/imm			
666128/min			
666129/		dead	
666130/		dead	

666131/del	0936	fractured femur, upgrade to imm	1056 to CHOMP
666132/min			1010 van to WCH
666133/min		cuts and bruises	1010 van to Watsonville
666134/min			
666135/min		lacerations, fractured humerus	1010 van to WCH
666136/min			1010 van to WCH
666137/del		cut artery, fractured radius	1010 van to WCH
666139/min			1010 van to WCH
666140/min		gash on hand	1010 van to WCH
666142/imm		0945 immobilized	0958 helo to NMC
666143/min		broken arm	1010 van to WCH
934133/ imm			

From this record, the numbers of each victim type are

6 no ID	17 minor	16 delayed	22 immediate	5 dead	Total 66
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and 2 of the delayed later died. This does not agree with the counts taken during the exercise and the reason for the discrepancies is not known.

SECTION III - MODELING

BASIC MODEL STRUCTURE AND PARAMETERS

The model is a decomposition of disaster response actions into processes, these processes into activities, and activities into events. The following sub-sections will explain this structure in some detail.

Disaster response consists of four basic types of action:

- assessment,
- decision making,
- communications, and
- physical activities.

The only assessment actions which will be treated as a separate entities are initial detection and evaluation of the incident. All other assessments will be included with their associated decision making processes.

Decisions in the model are essentially switches. They turn activities on or off and they can initiate communication. Communications provide information that are often precursors to decisions. We treat communications as movement of specific information along established paths, and include only information needed for decision making. Communication is represented by a time delay between the times of transmission and receipt of an information packet (object).

Physical activities are the movement of, or physical interactions between, people and/or things. For this exercise, physical activities include:

- transportation of
 - victims
 - rescue personnel
 - supplies and equipment
- treatment of victims
- utilization of supplies
- utilization of rescue personnel capabilities (fatigue)
- rescue personnel rehabilitation
- safety operations
- law enforcement and investigation
- area control

One has to be careful in the segmentation of activities. Even though triage involves physical interaction with victims, in keeping with the above statement on assessment, triage is considered a decision process, sorting patients and deciding which type of treatment they receive and when.

A simulation will represent reality only if the model is correctly parameterized. There are three types of parameters needed. The first could be designated as fixed parameters, such as:

- supply locations and amounts by type
- rescue personnel numbers, availability, and locations by type
- location of fixed treatment facilities
- rescue personnel capabilities
- rescue vehicle capabilities
- supplies needed for treatment
- communication capabilities

The second type of parameters are the times to perform various actions, such as:

- time to use the jaws of life and extricate a victim
- time to stabilize a critical victim
- time to communicate
- time to transport victims to a treatment facility
- time for decisions
- time rescue personnel can work without recuperation

The third type is used to specify the scenario:

- type and extent of disaster
- affect of disaster on local capabilities
- population distribution (for a widespread disaster)
- state and number of victims

Note that the victims in the scenario can be an input parameter (accident) or evolve as the situation unfolds, such as an earthquake or a spreading chemical cloud. For the latter situations, one normally has to run a hazard assessment model to obtain victim and property damage information. The response model does not contain this capability.

The purpose of the Naval Postgraduate School's participation in the Pacific Grove multi-casualty incident exercise was to determine model parameters that can represent response activities. For a specific exercise of this type, two types of data result: 1) data that is specific to that particular response configuration and 2) data that represents basic capabilities of response units. The second type of data becomes part of the data base for area response capabilities.

The model that evolves from the Pacific Grove exercise will be a replication of that exercise. It has wider utility because it represents the local implementation of the California SEMS. Thus, it can be used as a baseline model for a number of situations since the ICS structure used for setting up the response team is fairly universal.

MODEL ASSUMPTIONS AND RESTRICTIONS

Medical Module

The most crucial aspect of most disasters is rapid rescue and medical treatment for victims who are immediately affected by the incident. Medical response is a factor in all disasters and we first concentrate on developing the model's medical module. The Pacific Grove multi-casualty incident exercise is ideal for this purpose. In the medical module we include:

- on-site command and control of medical personnel
- medical personnel transport and assignment
- extrication
- triage
- on-site treatment
- movement of victims within site for treatment
- transport of victims to rear area treatment
- medical personnel mobilization at rear area hospitals
- provision, transport, and use of medical supplies
- personnel duty cycles
- decontamination
- on-site and rear area treatment capabilities and capacities

Note that this refers only to actual medical treatment, not to the many associated functions which are also modeled but not included in this module. The medical module provides a baseline of medical care modeling which can be used for a wide range of scenarios. It can be adapted to new situations by changing the magnitudes of parameters and by changing transportation end points. Changing the command and control structure away from an Incident Command System would involve more extensive model modifications. This reusability of the medical module is one of the reasons for initiating the project with its development.

Model Simplifications

Initially a simplified model will be developed, the main simplification being reduction in physical fidelity. The following are initial model features, including an indication of where simplifications have been made. Restrictions will be relaxed and more factors included as the model matures.

Operations Included: Most are represented by a processing time and a capacity.

mobilization	communications	decisions	triage
initial treatment	supplies utilization	personnel fatigue	personnel rotation
rescuer transport	transport to treatment	civilian evacuation	

Decisions: Decision making is represented by a time delay. Actions require precursor decisions. There are no human factors such as confusion and overload. Decisions reside in a decision tree so that a logical sequence of events is established.

Communications: Communications are represented by routes with time delays, with no overload nor queuing. All decisions rely on information being available at the decision node.

Inhomogeneity: Spatial inhomogeneity is not included in detail. Rather, means and variances are used to represent parameter spatial variations. For example: a toxic agent will normally impact only a specific geographical sub-region, but we use a random number generator to determine which individuals within the total area get sick and when they die rather than determine locality differences in exposure.

Facilities Locations: Facilities are not in definite locations. Rather, average distances to facilities are used, e.g. people to treatment, supplies to needed locations. The number of a type of facility in the area (facilities density) determines its average distance.

Transportation: Geographic routes are not considered. Rather, routes are represented by distances and transport types have velocities. Traffic jams for specific routes and route reassignment are not treated. Capacity limits are placed on individual vehicles, not on routes.

Geographic Representation: Geography for a region is represented by mean values for facilities locations, transportation times, population densities, etc. An exception for this exercise is hospital location. CHOMP is much closer than the other hospitals, so transport to it is represented by one time and other hospitals by their average.

Command and Control Evolution

As was noted in the lessons learned, Ref. 5, at the initial stages of disaster response rescuers are doing their jobs with little apparent direction while the command and control system is being set up. We plan to have the model separate the walking wounded during this phase and use average rates for all other victim response activities. The next exercise will properly phase in the command and control structure by more comprehensive communications data collection.

MODEL STRUCTURE: PROCESS LINES, ACTIVITIES, EVENTS, AND CODES

In order to extract parameters from exercise data, one needs to know which parameters are needed and how they will be used in the model. This is shown in this sub-section by presenting the basic model structure. The next sub-section presents the parameters.

The four basic activity types referred to earlier (how long it takes to get things done, activities capacity, required supplies, and required personnel) are segmented into defined rescue activities, and these activities placed within logical process lines. Each process line contains one or more activities, e.g. the on-site treatment process contains triage, victim treatment, and patient loading.

Within each activity are events, which are the key to the model's structure. Events are most often identified because they initiate an activity. Events are linked within their own process line or to events in other process lines by decisions, information, or physical occurrences. The network of linked events forms the structure of the model.

Model parameters are directly associated with events. Examples are the time it takes to perform an action once an event has occurred, or a supply quantity needed for an action.

The process lines are:

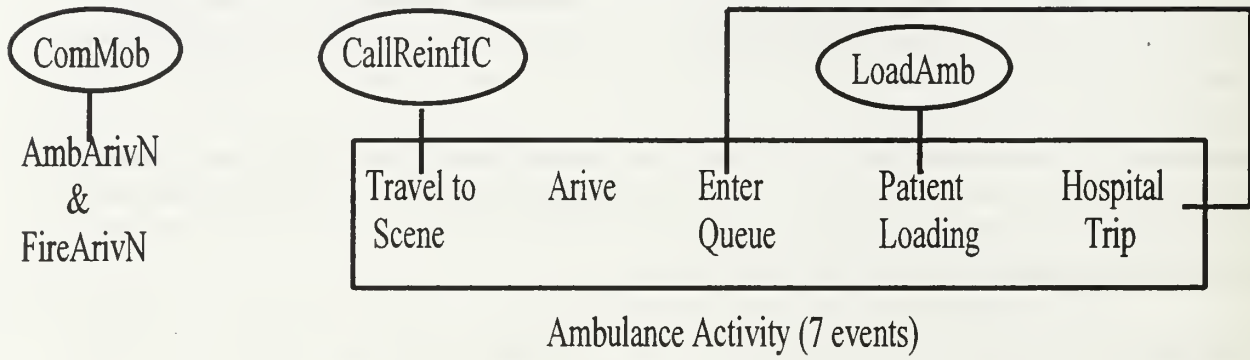
- Initiation
- Command and Control
- Rescue and Supply Vehicles
- Rescue Personnel
- Rescue Supplies
- Rescue
- On-Site Treatment, and
- Patient Transport Vehicles

The structure of process lines, activities, and events is complex. Figure 5 shows a very small portion of this structure for illustrative purposes. Events are named, and in the figure these names are underlined. All events have to be enabled before they can occur, and it is most often other events which do the enabling. Enabling events are indicated by being circled, with an arrow drawn to the event they enable.

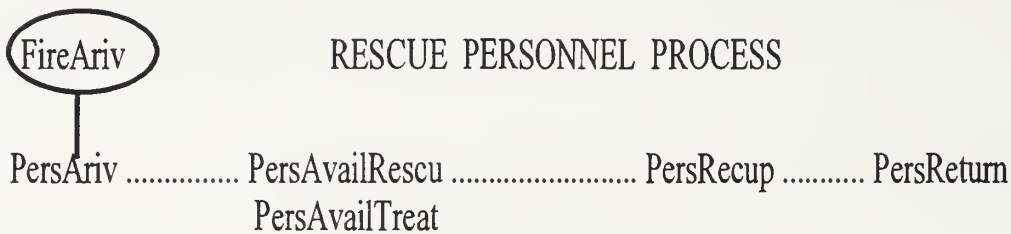
INITIATION PROCESS
Call911 ComMob

COMMAND & CONTROL PROCESS
..... CallReinfIC

RESCUE & SUPPLY VEHICLES PROCESS



RESCUE PERSONNEL PROCESS



RESCUE PROCESS



TREATMENT PROCESS



Extricate > MoveVict > > > > > Triage > > > Treat > > > LoadAmb

Figure 5: Schematic of model event network structure

Figure 5 shows small portions of six processes, and for each process a few events. As an example of what the figure shows, ambulances and fire vehicles will not arrive until County Communications mobilizes the area for a multi-casualty incident, which is done by the communications event ComMob. In the figure we show additional ambulance arrivals initiated by the call for reinforcements by the Incident Commander, CallReinfIC, for the ambulance activity block. Ambulances travel to the scene, then arrive (an event), enter the loading queue, have patients loaded, travel to the hospital, and return to the queue. Ambulances can't be loaded until the enabling event LoadAmb occurs in the Treatment Process.

Figure 5 also shows some personnel events. Personnel arrive on vehicles, thus are enabled by FireAriv, and become available for activities. Extrication can take place in the Rescue Process once the personnel become available, PersAvailRescu, etc. It is easy to envision that, when all processes and events are in place, the network becomes complex. The full list of events for this exercise follows in this sub-section.

Vehicles, personnel, and supplies are treated as enablers since they must be present for an activity to occur. The numbers of things and people change the rate at which actions in a process are carried out. Treatment is slower if the number of available rescue personnel for treatment is below a threshold. A complication is competing processes. Fully staffing a high priority task will reduce the number of people available for a lower priority task if personnel are limited. Rotation for recuperation makes people unavailable, who can later return, whereas supplies get used up and disappear. We do not consider transport of supplies or movement of personnel within the incident area, assuming they are available where needed when they arrive on site and are assigned a task. Ambulances are much the same as personnel since they become unavailable for a time when in transit to a hospital and then return to service.

Command and control are treated weakly in the current state of the model. This replicates the actual exercise performance where many activities started and continued with apparently little control. When a command and control structure was formalized and activated, the affect on operations was hard to detect in the data, even if it was apparent to the rescuers on site. The places where command and control made an apparent difference were

- mobilization,
- establishing an ambulance route and helicopter landing area,
- second wave rescue personnel assignments,
- reassignment of personnel when a task is complete,
- calling for additional supplies and personnel, and
- coordination of victim transport with hospital current capabilities.

There are simplifications in the current status of modeling. We do not discriminate treatment needed or given the various victims in treatment lines (immediate, delayed, and minor). For each category, averages are used. We do not currently model area control, law enforcement, or recuperation facilities. Rescuer recuperation is handled with the average time they can work and the average recuperation time. These averages simplify the data reduction and model structure.

The following is a listing of those events within each process line that are needed to create the model structure. Each event is given an identification code. For each event, an enabling event is identified (using these same event codes) that must occur before the event in question. The model is much easier to construct if there is only one enabler for each event. This is not quite possible, but by constructing a large number of events one can come close.

<u>Process Events</u>	<u>Event Code</u>	<u>Enabling Event</u>
<u>Initiation Process</u>		
This process line is used to initiate the simulation, the main purpose being to properly time the rescue activities after the event occurs.		
It is basically command and control.		
incident occurs	Incid	
call to 911	Call911	civilian observation
County Coms call local law	CallInit	C911
law enforcement arrival	LawAriv1	CallInit
law enf calls details to Cnty Coms	ComSitu	situation appraisal
Cnty Coms mobilization command	ComMob	ComSitu
Cnty Coms call for supplies	ComSup	ComSitu
Cnty Coms appoints base hospital	ComBHosp	ComSitu
<u>Command and Control Process</u>		
These are events that occur at the incident site or are transmitted from the incident site, such as requests for additional resources.		
Base hospital communications are also included.		
Incident Commander in place	IC	LawAriv1 or FireAriv1
establish ambulance route	AmbRoute	IC
establish staging area	StageArea	IC
establish helo landing area	HeloArea	IC
establish rehabilitation area	RehabArea	IC
internal personnel request	AskPers	assessment
request additional supplies	CallSupIC	assessment and attrition
request additional personnel	CallReinfIC	AskPers
hospital facilities appraisal	HospAppr	ComBHosp
appoint transport group supv	TransGrpSupv	IC
assign patients to hospital	PatAssn	TGS, Triag, & HospAppr
<u>Rescue and Supply Vehicles Process</u>		
This is the movement of vehicles to the incident site to provide personnel and supplies. Vehicle movement to transport patients is in another process line.		
first ambulance arrival	AmbAriv1	CallInit
first fire vehicles arrival	FireAriv1	ComInit
first police arrival	LawAriv1	ComInit

Red Cross services arrive	RedXAriv	ComMob
additional ambulance arrivals	AmbArivN	ComMob
Additional fire vehicles arrivals	FireArivN	CallMob
MCI supply arrival	MCISupAriv	CallSupIC
other waves of vehicles	AmbAriv2 &3	Call ReinfIC
due to reinforcement call	FireAriv2 & 3	CallReinfIC

Rescue Personnel Process

Personnel are complicated: they change activity as needs arise and duties are completed. The rates activities take place change as the number of people participating change. In all events that require personnel, it is understood that personnel becoming available is an enabler.

people arriving on vehicles	PersAriv	(vehicle)Ariv
personnel available for an activity	PersAvailZ	assignment and preparation
personnel recuperate	PersRecup	work time, RedXAriv
personnel return from recuperation	RecupRtrn	rest time

Rescue Supplies Process

We assume the supplies are available as soon as the transport vehicle arrives.

We do not track the use of specific supply item, rather assume a classification of victim requires a certain amount of the same type of supplies, and that a vehicle carries a specified amount of that type supplies.

supplies arriving on vehicles	SupAriv	(Vehicle)Ariv
supplies attrition due to use	SupUse	use for victim by type
restock supplies on ambulance	SupAmbRestk	AmbRetrn & AmbRestk

Patient Transport Vehicles Process

The arrival of ambulances is redundant with the ambulance part of the rescue and supply vehicles process line and is not repeated here. Here is the movement of ambulances when transporting patients and returning.

helicopter arrival	HeloAriv	ComMob
helicopter landing	HeloLand	HeloArea
ambulance available for loading	AmbAvail	AmbAriv or AmbRetrun
ambulance depart with patient	AmbPat	LoadAmb & PatAssn
ambulance arrives at hospital	AmbHosp	trip time
ambulance unloading patients	AmbUnload	arrival at hospital
ambulance restocking	AmbRestk	supplies shortage
ambulance depart hospital	AmbDep	unload and restock time
ambulance return from hospital	AmbReturn	trip time
helicopter depart with patient	HeloPat	LoadHelo & PatAssn
helicopter arrives at hospital	HeloHosp	trip time
helicopter unload	HeloUnload	arrival at hospital
helicopter refueling	HeloRefuel	flight time

helicopter return from hospital	HeloRtrn	unloading + trip time + refueling time if needed
minor injured vans arrive	VansAriv	ComMob
minor injured van departs for hosp	VanPat	LoadVan

Rescue Process

Rescue is the process of getting victims from their initial state to on-site treatment.

control physical hazards	Hazard	IC & FireAriv
extricate and initial triage	XtricMin	PersAvail & Hazard if needed
	Xtricate	
move minor injured	MoveMin	XtricMin
move serious injured	MoveSerus	Xtricate

On Site Treatment Process

This is treatment given at the site which attempts to stabilize victims and prepare them for transport. Victims cannot be loaded until their on-site treatment is completed. Prioritization for treatment and transport are the same decision.

1 st aid and release minor	AidMin	MoveMin
treat minor injured	TreatMin	MoveMin
load minor injured for transport	LoadVan	TreatMin & VanAriv
re-triage/prioritize injured	Triage	MoveSerus
treat delayed	TreatDel	Triage
stabilize & treat immediate	TreatImm	Triage
load on ambulance	LoadAmb	Triage & AmbAvail
load on helicopter	LoadHelo	Priority & HeloLand

PARAMETER RESULTS

The parameters that are listed below are specifically for the Pacific Grove, 22 Nov 97 exercise. The parameters are derived from the performance of the multi-casualty incident rescue team.

Each activity has one or more requirements that must be fulfilled before it can begin and a rate at which the activity can be carried out. The requirements can be simply expressed as:

Before an action can be taken on a victim, the victim must arrive at the activity.

Before an action can begin, the enabling event must have occurred.

Needed supplies and personnel must arrive before an activity can begin,
and sufficiency of both must be present for the activity to continue.

The basic rates at which actions are carried out vary with the details of the situation, but we use average rates in all cases. The rates also depend on the number of personnel available, which we assume to be a linear dependence which can only decrease the basic activity rate. E.g., if two rescue personnel can on-site treat a delayed victim in 5 minutes, four rescue personnel can do it no faster but having only one person available doubles the time.

The parameters listed here are not meant to produce an exact replication of exercise events and their times of occurrence. They are chosen so that they represent how an activity is carried out, on average, to give a good overall representation of response performance. E.g., we are interested in the rate at which victims were extricated rather than the exact time when each individual was extricated. We do need to capture when events or situations affected performance, such as ambulances not being available, and this is done with the model structure and parameters listed.

Recall that in the former sub-section we assigned codes to each of the responder events. Those codes are not the parameters, but we will use them to identify the parameters. The parameters are times of action initiation, rates at which actions take place, and physical capacities. The parameter codes and parameters are listed as follows:

Initiating Time: (Initiating event code + dt)
 For example: event Call911 (Incid + 2m)
 2 min is the parameter. The codes identify the event, the enabling event, and the time to wait after the enabling event.

Action Parameters: (event code) initiation time as above
 (event code)Rate rate at which the action occurs
 (Event code)NumMax the maximum number of things provided by the action, when appropriate.

Physical Capacities: Nxy(event) Ni is the number of items x associated with event, with y being shorthand for the event.

Use of the parameters shown here in the model is straightforward. For an activity to occur the initiating event must first occur. Sufficient personnel and supplies must also be available. Once these conditions are met, including the indicated time delay, the activity is turned on. As a reference, the total time, after incident initiation, when an event occurs is shown to the right.

<u>Event</u>	<u>Parameter</u>	<u>Total Time</u>
(Initiation Process)		
Call911	(Incid + 2m)	2 min
CallInit	(Call911 + 2m)	4 min
LawAriv1	(CallInit + 3m)	7 min
ComSitu	(LawAriv1 + 1m)	8 min
ComMob	(ComSitu + 1m)	9 min
ComSup	(ComSitu + 1m)	11 min
ComBHosp	(ComSitu + 4m)	12 min
(Command and Control Process)		
IC	(FireAriv1 + 0m)	10 min
AmbRoute	(IC + 19m)	29 min

StageArea	(IC + 8m)	18 min
HeloArea	(IC + 31m)	41 min
RehabArea	(IC + 65m)	75 min
AskPers	(IC + 27m) Rescue	37 min

This parameter is complicated. IC + 27m identifies when it occurred, but for robust modeling it should be preceded by an assessment of personnel needs by Rescue. See end of this sub-section.

CallReinfIC	(AskPers + 3m)	40 min
CallReinfIC2	(IC + 57m)	67 min
HospAppr	(ComBHosp + 4m)	15 min
TransGrpSupv	(IC + 2m)	12 min
PatAssn	(AmbPat + 0)	

Normally patient assessment would be tied to triage, but data to parameterize such action is not available for this exercise.

(Rescue and Supply Vehicles Process)

Vehicle arrivals have a beginning time, an average rate of arrival, and a maximum number. When there is more than one arrival sequence, the maximum number is the cumulative over all arrivals, not just for that sequence. If no rate is shown, only a single vehicle arrives.

AmbAriv1	(CallInit + 3m)	7 min
FireAriv1	(CallInit + 6m)	10 min
	FireRate = 1 every 2 min	
	FireNumMax1 = 3	
LawAriv1	given above	
AmbAriv2	(ComMob + 13m)	20 min
	AmbRate = 1 every 5 min	
	AmbNumMax = 5	
FireAriv2	(CallReinfIC + 8m)	48 min
	FireRate2 = 1 every 8 min	
	FireNumMax2 = 7	
LawAriv2	(ComMob + 0m)	9 min
	LawRate = 1 every 5 min	
	LawNumMax = 7	
AmbAriv3	none available in response to CallReinfIC	
FireAriv3	(CallReinfIC2 + 5m)	72 min
	FireRate3 = FireRate2	
	FireNumMax3 = 13	
RedXAriv	(ComMob + 11m)	18 min
MCISupAriv	(ComSup + 32m)	43 min

(Rescue Personnel Process)

Rescue personnel arrive on rescue vehicles. The parameters are the numbers on each vehicle type. PersAvail is not used for these data. We assume that personnel are available as soon as they arrive.

PersAriv	$Npa(AmbAriv) + Npf(FireAriv) + Npl(LawAriv)$ $Npa = 2$ $Npf = 3$ (for a multi-casualty incident) $Npl = 1$	
PersRecup	$(PersAriv + 90m)$ RecupRate = groups of 6 every 5 min RecupNumMax = Total Number of Personnel	100 min
RecupRtrn	5 min rest time	
PersRecup2	$(RecupRtrn + 60m)$	

(Rescue Supplies Process)

One unit of supplies must be available for a victim before care can begin. Supply use is tied to victim treatment, and the rate parameters are listed there.

SupAriv	$((vehicle)Ariv + 1m)$ $Nsa(AmbAriv) + Nsf(FireAriv) + Nsm(MCISupAriv)$ $Nsa = 4$ major care supply units $Ns1f = 5$ 1 st aid supply units $Nsf = 1$ major care supply unit $Nsm = 40$ major care supply units	
SupUse	$SUm = 1$ major care supply unit for each delayed or immediate treatment $= 2$ major care supply units for each transport if not treated on site $SU1 = 1$ 1 st aid supply unit for each minor treatment	
If 1 st aid supplies are exhausted, major care supplies can be used to treat minor injuries.		
SupAmbRestk	$(AmbRetrn + 1m)$ $Nsa = 4$ major care supply units with each AmbRetrn if AmbRestk $Nsa = 2$ major care supply units with each AmbRetrn if no AmbRestk	

(Patient Transport Vehicles Process)

HeloAriv	$(ComMob + 26m)$	31 min
HeloLand	$(HeloArea + 6m)$	47 min
AmbAvail	$(AmbAriv + 5m)$ $(AmbReturn + 2m)$	
AmbPat	$(2^{nd} \text{ patient LoadAmb} + 1m)$	56 min
AmbHosp	$(AmbPat + 8m)$ for CHOMP $(AmbPat + 45 m)$ for NMC and WCH	
AmbUnload	$(AmbHosp + 4m)$	
AmbRestk	$(AmbUnload + 1m)$ if needed	
AmbDeprt	$(AmbUnload \text{ or } AmbRestk + 1m)$	
AmbReturn	$= AmbHosp$	
HeloPat	$(2^{nd} \text{ patient LoadHelo} + 1m)$	58 min

HeloHosp	(HeloPat + 11m)	
HeloUnload	(HeloHosp + 12m)	
HeloReturn	= HeloHosp (no refueling)	
	= HeloHosp + 16 min (fuel needed)	
VansAriv	(ComMob + 12m)	21 min
VanPat	(LoadVan + 20m)	81 min

It is not known why the vans departed 20 min after loading, or how long it took to get all of the victims in the van.

(Rescue Process)

There is no set NumMax for rescue and treatment as there is for bringing in vehicles. The maximum number in each category depends on the number injured, which is a scenario input, not a model parameter.

Hazard	(FireAriv1 + 1m)	21 min
XtricMin	(LawAriv2 + 1m)	10 min
	XminRate = 1 every 30 sec	
	2 rescue personnel required	
MoveMin	(last XtricMin + 2 m)	

After the last minor injured is extricated they are moved as a group to their treatment area.

Details of rescue are not modeled; use average rates of extrication for all serious victims, with no treatment location differentiation, and move as soon as extricated. Initial triage is included in the extrication and move processes.

Xtricate	(FireAriv1 + 4m)	14 min
	XserusRate = 1 per minute	
	6 rescue personnel required, 2 absolute minimum	
MoveSerus	(Xtricate + 30s) for each victim	
	Rate is in Xtricate	
	4 rescue personnel required for litter bearing	

(On-Site Treatment Process)

AidMin	(XtricMin + 3m)	
	AidMinRate = 1 every 2 min to examine and release, no treatment required	
Treat Min	(XtricMin + 10m)	20 min
	TreatMinRate = 1 every 3 min	
	6 people required in treatment area	
LoadVan	(XtricMin + 41m)	61 min
	LoadMinNumMax = 15 for 2 vans	
Triage	(Xtricate + 16m)	30 min
	TriageRate = 1 min per victim	
	1 rescuer required for triage	
	4 rescue personnel required for litter bearing	

Triage and extricate run in parallel if there are sufficient personnel. The rate can double with double the personnel, but no faster. There is no differentiation between immediate and delayed treatment. Treatment and Prioritization are lumped into one action.

TreatDel	(Triage + 5m) to prepare for transport
	1 rescuer required for the 5 min basic treatment
TreatImm	same as TreatDel

Patients may be loaded for transport as soon as they have received the 5 min basic treatment. This action would normally control the loading rate, which would yield the parameter

LoadAmb (TreatImm + 1m),
as long as there are ambulances available to be loaded. In this exercise, there was a long delay before the first loading. This gives a different LoadAmb start time and removes the Treat process as an enabler of loading. This delay time and the actual loading rate will be used.

LoadAmb	(Xtricate + 40m) and subsequently	54 min
	(AmbAriv or AmbReturn + 5m)	
	1 min separation between patient loadings on one ambulance	
	4 rescue personnel required for litter bearing for loading	
LoadHelo	(Xtricate + 42m) and subsequently	56 min
	(HeloAriv or HeloReturn + 10m)	
	2 min separation between patient loadings for a flight	
	4 rescue personnel required for litter bearing for loading	

An additional control parameter is needed for patient transport, a maximum loading rate. To implement this, we impose a new parameter, the delay between loading subsequent patient transport vehicles:

LoadDelay	10m
-----------	-----

A good representation of the activities in the treatment area is difficult. One person can stabilize a victim for transport in 5 min. Thus, even when the number of personnel is short, victims can be readied for transport as soon as it is available. When more personnel are available, they provide additional care, including extending the survival of some victims, but do not shorten the time to ready people for transport.

The personnel requirements as a function of time are illustrated in Fig. 6. Only the rescue personnel working on-site are included. Ambulance drivers, public works, police, and rehabilitation personnel are not included.

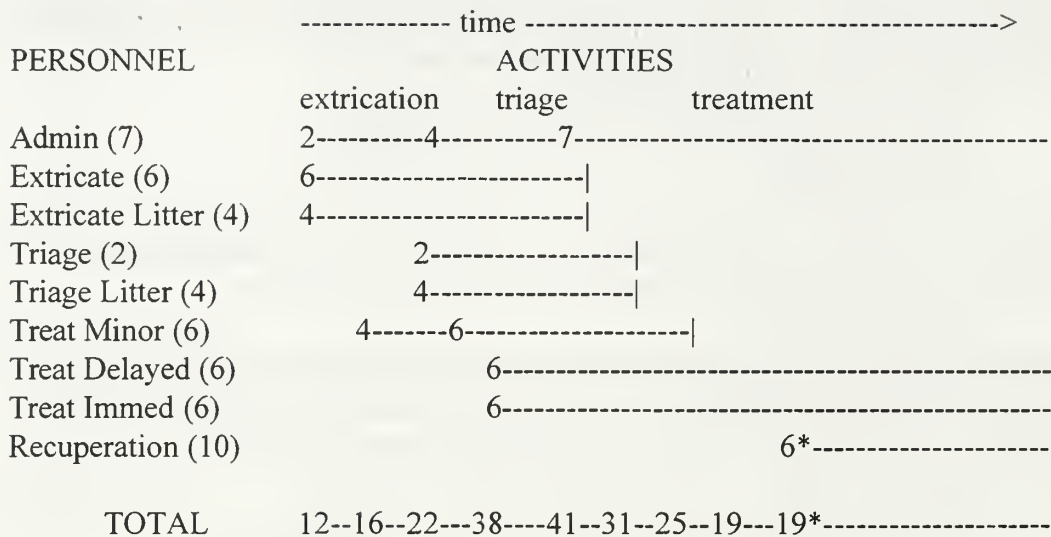


Figure 6. Schematic of rescue personnel requirements. The numbers of personnel required to fully staff the various rescue activities, as a function of time, are shown.

The time scale in Fig. 6 is only an indication, not quantitative nor linear. Some activities overlap, producing peaks in personnel requirements.

Fig. 6 does not include police activities. Police are used for the morgue and area control, both of which are not included in this version of the model. More important, the police initiate the identification and movement of the minor injured. This is not shown above, hence minor injured activities are shown starting with 4 treatment people. The model begins moving Minor injured as soon as the second police car arrives.

We assume that rescue activities get underway once the initial 12 people are available. Subsequent activities beyond extrication will not initiate until the additional required personnel are available. Litter bearing to take delayed and immediate victims to transport is provided from the 6 people in the treatment area. Recuperation is a special case.

*We assume that personnel going to recuperation does not disrupt other activities, hence the 19 people required toward the end of the exercise does not change as the 6 go to recuperation.

CONCLUSIONS

The Pacific Grove multi-casualty incident exercise and associated data collection have successfully produced parameters for a response model and simulation. This success is mainly due to matching the data collection to the response Incident Command System. Since the model must necessarily be matched to this system, there naturally results a correspondence between the needed model parameters and the information gathered during the incident. The following lists the major lessons learned from this effort.

1. Matching data loggers to the Incident Command System is an efficient and productive methodology for gathering response field data.
2. The efficiency of data collection is greatly enhanced by having data sheets that are tailored to the activity being monitored.
3. Some of the data collectors should have flexible assignments. This will allow shifting them to functions which have a peak in activity when it occurs.
4. Data collectors whose assignment is to observe general incidents for the area as a whole are needed. This will capture important events which can escape the notice of collectors assigned specific tasks.
5. Capturing Command and Control data was difficult. It was often difficult to monitor conversations being held between rescuers. It would be helpful in future exercises to have data collectors monitoring the radio frequencies being used for the incident.
6. If one wishes to obtain data for a higher fidelity treatment model, it will be necessary to track the rescue and treatment of individual victims. This will require more data collectors for these activities.
7. All data collection was by recording, in writing, on prepared log forms. The collection would be easier, and more high quality data would be obtained if tape recorders were used. The arduous task of listening to and extracting data from 20 plus recordings made this infeasible for this exercise. However, some means of employing recorders and staying within available manpower should be worked out for future exercises.

The next effort in this progression is completing the model and validating its performance. This will be done by determining if simulation results, using average parameters as has been described earlier in this report, closely enough replicates the actual exercise.

REFERENCES

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2. "Standardized Emergency Management System (SEMS), Implementation Regulations" California Code of Regulations, Title 19, Div. 2, Sec. 2407, California Emergency Services Act, California Government Code Sec. 8607 (a), effective Dec. 1 1996.
3. "Multi Casualty Incident (MCI) Plan, Monterey County Emergency Medical Services", Sept. 1, 1993.
4. "Emergency Services, Pacific Grove City Council Ordinance No. 97-37", Pacific Grove Municipal Code, Ch. 3.20, Aug. 6, 1997.
5. Miller, A., R. C. Coile, X.K. Maruyama, and G. E. Schacher, "Pacific Grove Multi-Casualty Incident Drill, 22 November 1997", NPS-IJWA-98-003, Feb 1998
6. "Hospital Emergency Incident Command System (HEICS), contained in Multi Casualty Incident (MCI) Plan, Monterey County Emergency Medical Services, Sept. 1 1993

APPENDIX Exercise Data Records

The following data records have been extracted from several sources:

ICS 214N data logs used during the 22 November, 1997
Pacific Grove Multi-Casualty Incident exercise.

County Communications Logs

Coordinating Hospital (CHOMP) Logs

Helicopter Logs

Ambulance Logs

The records show incidents and their time of occurrence. Logs have been combined into logical groupings where appropriate, e.g. into the Vehicle Events record.

	Incident Commander	PIO	Liaison Officer	Safety Officer
900				
901				
902				
903				
904				
905	Begin			
906				
907				
908				
909				
910				
911				
912				
913				
914				
915	IC Chief Glass			
916	Distribute Tags Call for blankets			
917				
918	update incident assn 6571 Ext/Triage			
919				
920				
921				
922	don ID vest			
923	designate staging area No. 7602			
924	send extrication group order 4 amb & helo	IC inform press & TV		
925	MTA helicopter declare crime scene			
926	designate traffic plan reassn fire contain to triage			
927				
928	assn Bitter to Rescue			
929	assn Brown Med Branch			

	Incident Commander	PIO	Liaison Officer	Safety Officer
930	assn 6412 to Med Brnch			
931				
932				
933				
934				
935				
936	coms with morgue			
937				
938	send med equip to treat			
939	6513 to extrication			
940	helo requ landing inst			
941	treat area established			
942	plan resource requests			
943	need extra people			
944	reconfirm staging area			
945	need 2 firemen land helo			
946				
947	landing zone set			
948	2nd jaws request			
949	short handed			
950	6211 on other side			
951	traffic plan established			
952				
953	change helo landing zone			
954	EMS stationed			
955				
956	coms 1 vict left in van			
957				
958				
959				
960	60 victims reported			
961				
962				
963				
964				
965	confirm stage area move			

	Incident Commander	PIO	Liaison Officer	Safety Officer
1000				
1001				
1002				
1003				
1004				
1005				
1006	critical debriefing			
1007	set up eating schedule 2 new fire to Trans Group			
1008				
1009				
1010	request assist from Carmel			
1011				
1012				
1013	no staging area			
1014				
1015				
1016				
1017	people needed			
1018	Assign Safety Off #2175A Assign Liaison Off		don vest	
1019				
1020				survey scene check with EMS
1021				assign safety duties
1022	prog rpt 8 moved from scene 15 to Wats waiting			
1023	Enough Resources Spreckles Declined		report adequate resources	check with Treat Mgr
1024	Salinas no resonse			
1025	8 vict moved reported assn Rec Cross Logis Chf			
1026	assn 2175A PIO			
1027				check bus scene
1028	recv 14d 14i 35m report			
1029	assn 5500 Ops Chief			

	Incident Commander	PIO	Liaison Officer	Safety Officer
1030				contact IC, check rehab check personnel
1031	Highlands declines			
1032	assn Operations Chief			
1033	outlying fire declines			
1034				need rehab supervisor
1035				
1036				
1037		KION interview		
1038				
1039				1 rescuer hurt back
1040	real incident report remove PIO vest	Miller film shoot		safety meeting
1041				
1042	Watsonville patient inquiry			
1043				
1044	ask next helo destination			
1045	helo needs 1/2 hr refueling	police interview		
1046	assn helo to Natividad assn 3 NCFD to Medical			
1047	receive helo ETA 1054			check vehicle fluid environmental impact
1048		KION interview Red Cross		
1049				report to IC
1050		Medical Branch interview		get personnel records from Treat Mgr
1051				6513, 6571 PARS
1052	Air Ops checked in 15d, 19 i report			
1053				
1054				
1055	give news interview	IC interview		
1056	28 victims on scene, 62 total report			
1057				
1058				check Landing Zone safety
1059				

	Incident Commander	PIO	Liaison Officer	Safety Officer
1100				
1101				
1102				
1103				
1104				
1105				
1106				
1107	report 34 transported, 13 i on site	PG Fire interview		
1108				
1109				
1110				
1111				
1112	assn helo to Salinas			check OPS on vehicle movement
1113				
1114				
1115				
1116				
1117				
1118				
1119				
1120				
1121				
1122				demobilization alert clear area
1123				
1124				
1125				
1126				
1127				
1128				
1129				

	Logistics Sect Chief	Operations Officer	Personnel Staging	Equipment Staging
900				
901				
902				
903				
904				
905				
906				
907				
908				
909				
910				
911				
912				
913				
914				
915				
916				
917				
918				
919				
920				
921				
922				
923				
924				
925				
926				
927				
928				
929				

	Logistics Sect Chief	Operations Officer	Personnel Staging	Equipment Staging
930				
931				
932				
933				
934				
935				
936				
937				
938				
939				
940				request 2nd jaws
941				
942			2 from fire crew to extric.	
943				
944				
945				distribute litter boards
946				
947				
948				
949				
950				
951				
952				
953				
954				
955				
956				
957				
958				
959				

	Logistics Sect Chief	Operations Officer	Personnel Staging	Equipment Staging
1000				
1001				
1002				
1003				
1004				
1005				
1006				
1007			12 more fire. on scene 1 medical for break	
1008			no stage mgr, staff short	
1009				request for straps, c-spine gear, and collers
1010				requ. for roller bandages, can't get
1011				
1012				
1013				
1014				
1015				
1016				
1017				
1018				
1019				
1020				
1021				
1022				
1023				
1024			report adequate resources	
1025			rehab area set up	rolling stretcher brought out
1026				
1027				
1028			4 fire to rest	
1029			1 more to rehab	

	Logistics Sect Chief	Operations Officer	Personnel Staging	Equipment Staging
1030		don ID vest	groups of 6 to rehab	
1031		check communications 5211 call in	call Logistics for juice	
1032			work about 1 1/2 hr before break	
1033		contact Salinas 5500 instruct on route	breaks 3-5 min	
1034		develop Operations plan		
1035				
1036				
1037				
1038				
1039				
1040		get EMS vehicle report coms Wats can take 4		
1041		supervise operations	Logis brings in juice and supplies	
1042				
1043				
1044				
1045		determine resource needs brief ops personnel		
1046		extrication complete		
1047			regular rehab flow	
1048				
1049				
1050			65-89 fire fighters on scene	ON SCENE
1051				11 fire engines, IC van, 1 fire pick up, logistics van, 2 food trucks, 1 civilian car,
1052		Safety calls for advice		6 patrol cars, 2 trucks, EMS truck and trailer,
1053				2 fire trucks
1054		meet with IC		
1055	water to road block		temp relief to road block	
1056		change helo coms to Air Br.		
1057		brief PIO		
1058				
1059				

	Logistics Sect Chief	Operations Officer	Personnel Staging	Equipment Staging
1100	5.7 gal gas, 2 qts trans fluid to Red Cross		10-15 at Red Cross	
1101			IC coffee break	
1102		confer w Med Brnch		
1103				
1104		morgue wants bus moved		
1105				
1106				
1107		briefing on moving bus		
1108		check injured		
1109				
1110	request food for flight crew	slow down ambul returns		
1111				
1112				
1113				
1114				
1115				
1116		confer at rehab		
1117		7511 completes rehab		
1118				
1119		report to IC		
1120	flight crew gets food			pack up litter boards
1121				
1122				
1123				move tow truck to wrecks
1124				
1125				
1126				
1127				
1128		ON SITE 5510, 7511, 5211, 5313,		
1129		6571, 6611, 6573		

	Fire Branch Director	Rescue	Medical Branch Director	Extrication/First Triage
900				
901				
902				
903				
904				
905				
906				
907				
908				
909				
910				
911				
912				
913				
914				
915	check communications		don ID vest	start serious triage
916	review assignments direct extrication start			treat who can reach move and tag dead
917		determine #53 & #54 dead ext 2 bus back door		
918				
919				
920		3 more out bus back door		
921				
922				2imm 2dec 2 del extr
923	assign physical ops and extr groups	2 more delayed from bus	pass out triage tags	
924		1 imediate out		
925				
926	request equipment and personnel	3 rescuers in bus to help 1 imm out		minor injuries separated
927				
928				
929		ask for walking victims		

	Fire Branch Director	Rescue	Medical Branch Director	Extrication/First Triage
930	assign litter bearers	enter bus front cut front seat		move victims
931	assess bus front vict	3 imm out bus front		organize area move serious to amb area
932				
933				
934				
935	address treatment group	#23 out of bus	immediates on boards	
936		first back boards on scene		
937		decide cut front of bus		
938	coordinate with Transport Group Supervisor	cover victims with blankets		
939				ran out of tags lay out tarps
940				short of personnel
941		cut bus bars with jaws	neck wounded on boards	
942	lay out tarps	1 out on back board		
943			look for immediate victims	
944		work both ends of bus	move victims to tarps	
945		going in van sun roof		still extricating EMT crew retriaging
946			tend to immediates	
947		1st victm from van		
948				
949				
950		1 out on back board leave 3 dead on bus		
951		extrication complete		
952				
953			vict lying by van tape area	
954			neck brace on 2 imm for helo	
955				
956				
957			victims to helo	c-spine and back boards ordered
958				
959			get victim count	2 rescuers per patient

	Fire Branch Director	Rescue	Medical Branch Director	Extrication/First Triage
1000		9 deceased		
1001				
1002		covering bodies	tell IC num of injuries	
1003			pass out vests brief team	
1004				
1005				
1006			assemble strike team ask if TGS needs personee	
1007				
1008			requ equip and personnel inventory from groups	
1009			plan 6 by air	
1010				
1011				
1012				
1013				
1014		14 deceased	requ TGS come to medical	
1015				
1016				
1017				
1018				
1019				order more supplies
1020			notify extric of equip needs	walking wounded to van send people to rehab
1021				
1022			8 patients moved 15 ready for WCH	
1023				
1024			receive resources OK rpt	
1025				
1026				
1027				
1028			assign runners	
1029				

	Fire Branch Director	Rescue	Medical Branch Director	Extrication/First Triage
1030	don ID vest		head count, ask if resources needed	
1031			requ 2 more engine companies	
1032				
1033				
1034				
1035				
1036				
1037			rescuer strains back	
1038				
1039				2 patients to CHOMP
1040				2 more to CHOMP
1041				
1042				
1043				
1044				
1045			operations briefing	
1046		move deceased to morgue area		
1047			count 14 sent, 14 min rem	
1048		ask to take deceased out of bus	19 remain for care 15 in morgue	
1049			get ambulance briefing	
1050			ops briefing complets 60 cared for	
1051				
1052				2 patient to CHOMP destination confusion
1053			move patients closer to helo landing	
1054				
1055			inspect area	
1056				
1057				
1058				
1059				

	Fire Branch Director	Rescue	Medical Branch Director	Extrication/First Triage
1100		1st deceased from bus	Speak to patients	
1101				
1102			load patients on helo	
1103				
1104				
1105			count 13 remaining	
1106				
1107		15 deceased		
1108			check reuse of resources	
1109				
1110				
1111			2 to NMC	
1112				
1113				
1114				
1115				
1116		all deceased out of bus		
1117			10 victims remain	
1118			release some fire fighters	
1119				
1120				
1121				
1122				
1123				
1124				
1125				
1126				
1127				
1128				
1129				

	Transport Group Supv	Ambul Staging	Air Branch Director	Treatment Group Supv
900				
901				
902				
903				
904				
905				
906				
907				
908				
909				
910				
911				
912				
913				
914				
915	don ID vest			
916	Medical Branch briefing			
917				
918	check scene			
919	start triage			
920	reassure people			
921	estab coms with MICN			
922	coms for 2 vans to WCH			
923	report 40 victims			
924	insure transportation sufficient			
925	2 vans arrive		get ETA for helo estab pick up point	
926	verify communications		estab radio channel	
927				Medical Branch briefing
928				set up treatment triage
929	establish ambulance arrangement			

	Transport Group Supv	Ambul Staging	Air Branch Director	Treatment Group Supv
930	transportation established			
931				
932				
933		CCT-3 arr boards from 846		stretchers to treat area
934	set up ambulance route			
935		2 boards from CCT-3 AMR assigned Amb Stage		
936				
937	move, area too congested	2 boards from 844 oxygen from 844		
938				estab treat area assign paramedics
939				
940	insure transport capability			estab coms with treatment managers
941				
942	move patients			
943				
944	log triage tags	5th ambulance arrives		
945				assign re-triage
946				
947	ready for transport			
948				com sites to Med Brnch Dir
949				
950				assure prioritization advise Trans Grp Supv
951	insure transport capability	Trans Grp Supv briefing		
952		stretcher from 846		assign 2 patients to helo
953	confusion on destinations			
954	report 26 immediate		triage 2 helo victims	
955		2 loaded for CHOMP estab coms with Fire & TGS	move 1st to helo	
956				
957	request blankets commence loading			
958				move ambul to immediate
959	coordinate with hospital	stretcher from CCT-3 CCT-3 to NMC	secure helo for lift off	

	Transport Group Supv	Ambul Staging	Air Branch Director	Treatment Group Supv
1000				coord loading with Trans Group
1001				
1002				assure supplies available
1003				
1004		both vans (15) filled		
1005		1 patient into 829		
1006			Med Group briefing	
1007		2nd patient into 829		
1008				
1009	reassign xport units after transport			
1010				
1011	set ambulance rotation			
1012	836, 840, 828, 82?, 841 available			
1013				
1014		will have 5 ambul max		
1015				
1016	adv Med Brnch Supv of add resource needs			
1017				
1018				
1019	Med Brnch Supv Confer			
1020		CCCT-3 leave for Wats		
1021		White van leave for WCH		
1022	8 moved out, 15 ready			call for rehab personnel
1023				
1024	15 walking ready for WCH			
1025				
1026				
1027				cover dead bodies
1028		infant to morgue		
1029	coord with Air Brnch Dir			

	Transport Group Supv	Ambul Staging	Air Branch Director	Treatment Group Supv
1030		843 to CHOMP		
1031				
1032				
1033	triage tag problem			
1034				
1035				
1036				
1037	request helo to NMC			
1038	NMC full			
1039	request 1 imm to CHOMP	846 to CHOMP		
1040				
1041	12 have been transported			
1042				
1043	2 to NMC by helo 2 more to NMC			
1044		no more ambulances		
1045	Operations briefing try coms CAL5			
1046				
1047				
1048				19 immediate left
1049				
1050		mother & baby in 844 to CHOMP		
1051				
1052				take dead to morgue
1053				
1054				
1055				
1056				
1057				
1058			helo lands	
1059			direct helo to NMC	

	Transport Group Supv	Ambul Staging	Air Branch Director	Treatment Group Supv
1100	16 transported		assess patients for flight	
1101			load patient	
1102	waiting for ambulance		load patient	
1103				11 dead in morgue
1104			helo departs	
1105				11 remain for hospital
1106				
1107				
1108	delay in patient movement			
1109				
1110				
1111				
1112		amb 846 arrives		
1113				
1114	2 by ambulance to CHOMP			
1115		843 to CHOMP		
1116				
1117				
1118	2 by amb to CHOMP			
1119				
1120	demobilize	846 to CHOMP		
1121				exercise ends
1122				
1123				
1124				
1125				
1126				
1127				
1128				
1129				

	Re-Triage	Immediate Treatment	Delayed Treatment	Minor Treatment
900				
901				
902				
903				
904				
905				
906				
907				
908				
909				
910				
911				
912				
913				
914	move walking victims assign victims to areas			
915				
916				
917				
918				remove victims treat victims arm
919				
920			Treatment Group set up	
921		remove T#637		
922			ID 5 as delayed	
923				talk with distressed victims assign 13 to van
924				
925		Trans Grp Supv briefing		begin treatment
926		request personnel and supplies		obtain briefing request personnel & suppl.
927		move patients		
928				
929				about 12 treated

	Re-Triage	Immediate Treatment	Delayed Treatment	Minor Treatment
930	insure tags correct			
931				
932				
933	move immediate to triage			
934				
935		establish victim needs and priorities		
936			ID 2 as delayed	
937				
938				
939				inform TGS of support needs
940	everyone out? direct to treatment areas		move delayed to re-triage	separate victims by needed care
941				
942				
943				
944				
945	request medics, supplies and litter bearers			
946				
947				
948				
949				
950				
951				
952		load ambulance #846		
953				
954		1 to helo 1 to helo		
955				
956				
957				
958				
959				

	Re-Triage	Immediate Treatment	Delayed Treatment	Minor Treatment
1000			set up delayed treat tarp	release no-care victims insure depart safely
1001				
1002				
1003				
1004				
1005	pregnant patient on board		upgrade 1 to immediate take status count	
1006				
1007				
1008				
1009				
1010			walking delayed to van	
1011				
1012	load van for WCH			
1013				
1014				
1015				
1016				
1017				
1018				
1019				
1020				
1021				
1022				
1023				
1024				
1025				
1026				
1027				
1028				
1029				

	Re-Triage	Immediate Treatment	Delayed Treatment	Minor Treatment
1030				
1031				
1032				
1033				
1034				
1035				
1036				
1037				
1038				
1039				
1040				
1041				
1042				
1043				
1044				
1045				
1046				
1047				
1048				
1049				
1050				
1051				
1052				
1053				
1054	prioritize patients			
1055	start personnel records			
1056				
1057				
1058	count victims			
1059				

	AMR Logs	Site Communications	Helicopter Logs	County Communications
900				
901			at monterey airport	
902				
903				
904				
905		Start Exercise		
906				bus overturned call many injuries reported
907				
908				location report
909	#836 dispatched			call MCI
910				additional responders need
911	#836 at site			location ID
912				CHP advised
913				
914	#840 dispatched			MCI trailer needed form fire strike team
915	#829 dispatched			PM notified MCI 570 pol request MCI
916		communications check		T6571 on scene
917				advise Santa Cruz of MCI call CV amb, no response
918				
919				CHP on scene, DUI, notify CHOMP MCI, call MC/EMS
920				E6412, E0612 en route E6513 on scene
921		Trans Grp establish MICN communications		orange frequency assigned
922				CH 6406 back
923	#828 dispatched			EMS notified Harry advised
924		press and TV notified		page MRY airport for trailer
925		Air Branch establish radio channel		call for 2 off duty police for morgue
926	#840 at site			CALSTAR advised and en route
927		IC to Triage	MCI activation from County Coms	
928	#829 at site			
929				request contact coroner

	AMR Logs	Site Communications	Helicopter Logs	County Communications
930		IC cell phone to dispatch to confirm resources		
931		IC-Treat Grp add resources		CALSTAR ETA + 5 min
932		use tactical Silver		
933			lift off from MRY	advise Coast Guard of drill Navy fire advised
934				
935		Airport to IC, helo on way		
936	#828 at site	IC helo 3 min out	arrive accident scene no landing zone	
937				
938		helo requests land zone		
939		Treat Grp establish coms with treatment mngrs		police call for Landing Zone
940				
941				
942				Land Zone communication
943				
944				
945				
946				
947				Marina advises can't respond
948				E5501 responding
949				police ask if PIO established
950			land at incident site	
951				
952		commun land zone with hospital		CHP can't com with PG on portable
953				
954				
955		Trans Grp establish coms		
956				6 deceased confirmed
957				Highlands declines
958		Highlands declines		
959		Law calls for Mry status		

	AMR Logs	Site Communications	Helicopter Logs	County Communications
1000				
1001	#828 depart with 2		take off for WCH	
1002		police coms bad		
1003		victim count report 9 dec 14imm 35 del/min		
1004				
1005		Coroner on way		
1006				
1007				
1008				
1009				
1010		request Carmel assistance		14 dead confirmed
1011				
1012		Crml can't provide type 1	land at WCH	
1013		Med Brnch requ Trans Grp presence		
1014	#840 depart wwith 2	Amb Stag report 5 ambulance max		CH6500 dead confirmation
1015	#829 depart with 2	police request radios		coroner updated
1016		no coms vans to hospital		
1017				
1018				
1019	#828 arrive CHOMP	equipment transport to Trans Grp		Spreckles refuses
1020		Med Brnch notify of needed equipment		5211 will respond
1021	#840 arrive CHOMP			
1022	#840 dispatch #2	report 8 moved, 15 to WCH		ME5313 respond for Salinas fire
1023		Spreckles declines Coroner on way		
1024		report to Med Brnch resources OK	lift off from WCH	
1025				
1026				
1027		helo requests next destin		
1028		victim report		AMR M calling back CALSTAR
1029				

	AMR Logs	Site Communications	Helicopter Logs	County Communications
1030	#840 arrive site	Med Brnch requests 2 more engine companies		
1031		Highlands declines WCH reports full		
1032				STAR 1 to where?
1033				
1034	#836 depart with 2			coms with STAR 1
1035				
1036				
1037				
1038		Trans Grp, NMC full		
1039				police 871 en route
1040		real incident reported EMS vehicle report	land at MRY for fuel due to long hover time at site	
1041		WCH says can take 4 more		
1042		WCH inquires about number of patients		
1043	\$840 depart with 2			
1044				CH 6500 wants STAR return to land zone
1045		helo reports need of 1/2 hour for refuel		
1046				MRY reports STAR refueling
1047		helo reports ETA 1054		
1048		Safety calls Ops Officer for advice		
1049				
1050				
1051				
1052				
1053				
1054				
1055				
1056			lift off MRY airport	
1057				
1058				
1059				

	AMR Logs	Site Communications	Helicopter Logs	County Communications
1100				
1101				
1102				
1103				
1104	#840 arrive CHOMP	morgue to Ops Officer wants bus moved		
1105	#836 arrive CHOMP #829 arrive NMC			
1106	#840 dispatch #3			
1107				
1108				
1109				
1110				
1111				
1112		coms brief by airport general manager		
1113				
1114	#840 at site			
1115				
1116				
1117				
1118				
1119				
1120		all hospitals report full		
1121				
1122				
1123				
1124	#840 depart with 2			Cml ETA + 45 at scene
1125				
1126				
1127				
1128				E661 returning
1129				

1140
 1144 #840 arrive CHOMP
 1154
 1155

E612 returning

 AMRM no disposition
 STAR1 complete
 demobilization declared
 EMS 870 in service

	Vehicle Events	Physical Occurrences	Law Enforcement	Victim Events	CHOMP MICN
900					
901					
902					
903					
904					
905					
906					
907					MCI Alert 40 + ? victims
908					
909			provide assistance to safety officer		
910	PG Police Arrive		provide assistance for victim control		
911			begin triage	police begin triage	
912	Amb Arr #834- (843) 2nd Police Arr				MCI activation
913	PG Fire 6571 Truck Arr			Pol move min inj to side 17 out	
914	2nd PG Fire Arr	Bus Driver Arrested			
915			determine if crime scene		CHOMP notified to be base hospital
916				remove walking move and tag dead	notify NMC
917				2 extr bus back door	notify SVMH
918	3rd PG fire arr	arrest woman driver			notify WCH
919					2-3 Crit ER, 4 ICU, 2 OR crews, 10-20 gen avail
920				3 out bus back door	NMC 15 ER, 0 ICU, unk OR 15-20 gen @1005 avail
921		begin on fire		tagging dead	WCH 6 ER, ICU closed, 1 OR, unk gen avail
922				2 imm 2 dec 2 del out	
923	red cross arr			2 del out of bus	
924	2 vans arrive	fire contained		1 imm out	
925	2nd ambulance arr				
926		fire fighters in bus		separate minor injuries	
927					
928		hose car again			
929					

	Vehicle Events	Physical Occurrences	Law Enforcement	Victim Events	CHOMP MICN
930			set up traffic control check coroner call	20 in bus, 20 sitting 3-4 dead	
931				3 imm out bus front	
932					
933		bring out back boards	operate morgue		
934			do body count chalk marking		
935				# 23 out of bus immediates on boards	
936		1st back boards on scene			
937	helo arrives				
938				cover victims with blankets	
939				triage complete	
940			preserve evidence		
941				neck wounded on boards	
942				1 out of bus on back board move victims around	
943				4 victims on tarp	
944	5th ambulance arrives			move victims to tarps	
945		going in van sun roof area contained reported	area contained	still extricating 6 victims immediate tarp	
946	EMS arr south side MC trailer arr				
947		more medical support arr		1st victim from van 13 victims on immed tarp	
948		med equip to treatment			
949					
950			measure area area secured	1 out on back board leave 3 dec on bus	
951				extrication complete	
952	helo landed				
953	2 trucks & bronco arr	helo stretcher unloaded			Coms 60+ vict, 25 crit, 20 walk, 2 still trapped
954	two fire eng around back			neck brace on 2 immediate for helo	
955			question drunk	1 ambulance loaded 25 critical, 2 trapped in bus	Coms CHOMP ETA 10-15 min with 2 imm
956					
957				1st victim to helo	
958				2nd victim to helo	
959	B271605 to CHOMP amb ready for Natividad		call for Monterey status		

	Vehicle Events	Physical Occurrences	Law Enforcement	Victim Events	CHOMP MICN
1000				9 deceased	
1001					
1002			communications bad	covering bodies	095669 & 095666 arrive
1003					
1004					
1005			not enough blankets to cover dead use sheets	patient into 829	
1006	ambulance to NMC				Coms CHOMP ETA 5-10 NMC ETA 25-30
1007		food to rescuers		2nd patient into 829	
1008					
1009				patients loaded	
1010	Salinas 5510 arr				
1011					
1012					
1013	ambulance departs				
1014	morgue established		request radios	14 deceased	
1015					
1016					
1017	Carmel Valley arr				Coms CHOMP ETA 5-10 NMC ETA 20-30
1018					
1019					
1020				walking wounded to van CCCT-3 leave for WCH	
1021					
1022	minor treat van departs			8 moved out, 15 ready	
1023					Coms WCH ETA 1025 still loading 14 by van
1024				15 walking ready for WCH	27685 & 095679 arrive
1025	coroner arrives		coroner arrives		
1026		rehab established			Coms NMC ETA helo unk Coms van leaving for WCH
1027					
1028			direct ambulances		
1029			second coroner arrives		Coms helo to WCH

	Vehicle Events	Physical Occurrences	Law Enforcement	Victim Events	CHOMP MICN
1030		coroner taking pictures			Coms CHOMP ETA 15
1031					
1032					
1033	ambulance arrival				
1034	ambulance departs ambulance arr				
1035					
1036					
1037					Coms CHOMP ETA 10-15
1038					
1039				2 patient to CHOMP 12 have been transported	
1040				dec from van baby only 2 more to CHOMP in 846	
1041			van driver arrested		095638 & 095682 arrive
1042				1st deceased examined	
1043				2 to Natividad by helo 2 more to NMC	
1044			move press		095639 & 664373 arrive
1045			talk to news		
1046				move deceased to morgue area	
1047				count 14 sent, 14 min remain	
1048				19 remain for care	
1049					
1050				60 patients cared for woman & dead baby to CHOMP	
1051					
1052				2 patients to CHOMP destination confusion	
1053				move patients closer to helo	
1054					
1055					
1056					
1057					
1058					
1059					095696 & 095700 arrive

	Vehicle Events	Physical Occurrences	Law Enforcement	Victim Events	CHOMP MICN
1100				1st deceased from bus	
1101					
1102				load patients on helo	
1103					
1104				helo takes off	
1105				2 loaded on helo count 13 victims remain	
1106					
1107				15 deceased	Coms 2 to CHOMP
1108					
1109		clean up trash			
1110			instruct on evidence under vehicle		095667 & 095678 arrive
1111					
1112	ambulance arrival				
1113					
1114					Coms CHOMP ETA 10-15 Coms requ on scene info
1115				2 in 843 to CHOMP	Coms requ no more xport
1116				all deceased out of bus	
1117				10 victims remain	
1118					
1119					
1120				2 in 846 to CHOMP	
1121					
1122	fastest ambulance turn around 40 min				095646 & 666131 arrive
1123					
1124					666126 & 095647 arrive
1125					Coms CHOMP ETA 10-15 last 2 xport
1126					
1127					
1128					
1129					

